Canadian Defence Beyond 2010
The Way Ahead

An RMA Concept Paper

RMA Operational Working Group
National Defence Headquarters
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Foreword

In May 1998, the Director General Strategic Planning (DGSP) and the Chief of Research and Development (CRAD) presented a report on the Revolution in Military Affairs (RMA) to the Defence Management Committee (DMC). Subsequently, DGSP and CRAD were made jointly responsible for studies related to the exploration of the RMA phenomenon. The mandate included the convening of a symposium and the production of this Concept Paper. DGSP and CRAD formed Working Groups with broad Departmental and Industry representation to carry out the required studies, convene the "Canadian Defence Beyond 2010" Symposium, and assist in the generation of this Concept Paper.

The aim of this Concept Paper is to present the results of the analysis to date. This paper is a product of DND/CF, academia and selected Industry collaboration. Findings from the Symposium have been incorporated, as have comments and suggestions from all Environmental Chiefs of Staff (ECS) and Group Principals. The wide-ranging inputs that have helped mould this document demonstrate the holistic approach taken in its construction. In seeking relevance when compiling this document, attention was paid to other ongoing DND/CF projects such as the *Defence Strategy 2020*, the *Military Assessment* and the *Force Planning Scenarios*.

While at first the Cold War's end seemed to promise a permanent draw-down of armed forces, it has become clear in these last years of the 20th Century that while the threat of global war is remote, conflict is more prevalent than ever. The close of the Cold War ushered in an era where international stability—a hallmark during the years of Soviet-American tensions—is unravelling. Today fractured states, national and international ethnic and religious rivalries, resource scarcity and its attendant issues have made the world a volatile and unpredictable place. Additionally, the Gulf War showed us, through the use of technical systems and platforms, that military personnel must be more intensively trained than ever before. In sum, the international environment is less stable, more unpredictable, and increasingly technically sophisticated. These facts place considerably greater demands on DND/CF and make it critical that capabilities which may be required in the future be examined today.

To effectively achieve this, time must be allocated first to thinking and then to the translation of that thought process into forward looking documents which realistically examine Canada's future defence requirements across the spectrum of conflict. A dedicated effort in these areas has the potential to generate intelligent plans and documents that chart a course towards the future while being grounded in today's realities.

This Paper will examine the possibilities offered by new technologies and the concurrent changes they allow (and often necessitate) to armed forces' doctrine and organization. In undertaking this study, caution must be exercised to avoid either being lulled into thinking that technology offers a "silver bullet" solution, or that technology will make war a more humane practice (a push-button affair) where casualties become non-existent. Moreover, technology pursued without corresponding alterations to doctrine and organization will not allow DND/CF to fully profit from the far-reaching changes that are occurring in the war-fighting arena.

The findings and conclusions of this document in no way purport to offer the definitive way ahead for DND/CF. This Paper is not meant to provide a step-by-step process to get the Department and the Canadian Forces from 1999 to 2010 or 2025. Instead, the Paper identifies areas that need to be examined; in some cases, solutions to the problems are proposed. Although this Paper strives to identify areas where DND/CF can co-operate and engage with the U.S. and other allies, it is recognized that we must concentrate on Canadian missions and interests in this collaborative effort. The authors of the Paper are fully aware that overall funding levels for DND/CF may not increase significantly between now and 2025. Finally, this document does not, and was never mandated to, provide new war-fighting doctrine. However, it does recognize the interdependent nature of doctrine, technological change and organizational re-structuring. Therefore, as the latter two areas develop, new doctrine will have to be written to reflect these changes.

Currently, the Defence Management Committee has initiated a concerted effort to develop a strategic approach towards the future. In this document, the views and recommendations on future defence trends in five key areas of DND/CF are woven into a coherent whole. Finally, recommendations are made that permit the development of a strategy for DMC consideration as it sets the future course for DND/CF.

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31 May 1999

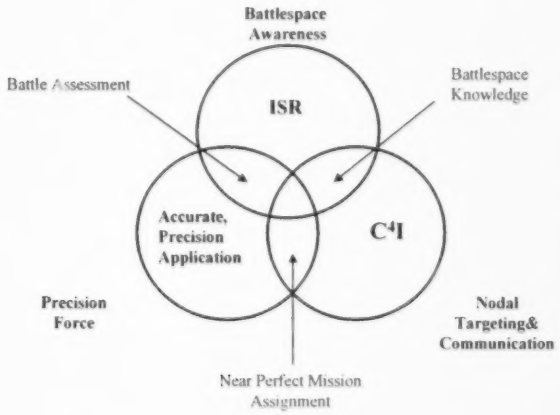
Executive Summary

The conduct and character of war is changing. Essentially, rapidly integrating technologies (information, sensor, and precision technologies) are effecting massive changes in our global society, and in how business and the military operate. In the widest sense, the information age is replacing the industrial age. In the military sphere, the application of advanced technologies is viewed by many as a Revolution in Military Affairs (RMA). Although the United States is leading the investigation and application of the RMA, Canada's allies, such as the United Kingdom and Australia, are also pursuing these developments to ensure that they maintain modern and interoperable forces for the 2020-2025 time frame. DGSP/CRAD were made joint OPI's for the development of a Canadian perspective on the RMA. The mandate included convening a Departmental Symposium (30 Nov - 1 Dec 1998) and producing a Concept Paper on Canadian Defence Beyond 2010.

The Revolution In Military Affairs

In essence, a Revolution in Military Affairs is a major change in the nature of warfare brought about by the innovative application of new technologies which, combined with dramatic changes in military doctrine and operational and organizational concepts fundamentally alters the character and conduct of military operations.

According to this definition an RMA addresses three elements: technological change, doctrinal innovation, and organizational adaptation. In each of these elements, there have been significant advances in recent years. The rapid advancement of information technology and information systems holds forth the prospect of dramatically altering command and control of armed forces. Coupled with major advances in precision, lethality and miniaturisation, to name but three, this fact might alter significantly the way armed forces operate across the spectrum of conflict. Doctrinal and organizational changes currently under consideration seek to capitalise on the technological advances effectively to change the way militaries would apply force. The figure below portrays this visually. The intersection of developments in the three spheres represents the point at which an RMA can be said to occur.



This Concept Paper begins with a chapter that examines the future security environment. This overview confirms that the future is uncertain and that international instability, fractured states, asymmetric threats (e.g. WMD, information operations, international terrorism, international crime, etc.) along with the proliferation of conventional military technology have made the world a volatile and unpredictable place. Moreover, the international environment is becoming increasingly technically sophisticated. Next, the role of the United States, the UK, Australia, France and Germany with respect to the RMA is examined. Although the US is most actively leading developments in this field, other nations are preparing for the single integrated battlespace concept (the air, land, sea and space—including the electromagnetic spectrum—and the included friendly and enemy forces, and equipment within the area of interest) of the future.

The Concept Paper then closely examines five key DND/CF areas with respect to Canada's future defence direction. These five areas are: Operations; Science and Technology; Material Acquisition and Support; Industry/Defence Interdependencies and Human Resources. From the five areas, there emerged a number of key recommendations.

Key Recommendations

The first recommendation concerns the establishment of a working group, to ensure that a coherent well-defined DND/CF approach to 2010 and beyond is realized. Reporting to the VCDS, this group would include subject-matter experts from key parts of DND/CF, and would be led by a Flag/General Officer.

Second, a systematic approach to interoperability within DND/CF and with our allies is required. International agreements with Canada's allies must be used to pro-actively promote optimum future interoperability and the establishment of common equipment standards.

Third, the area of asymmetric threats requires consideration, and there are a number of subordinate recommendations that deal with this. A national infrastructure vulnerability centre should be established to co-ordinate Canada's response to domestic asymmetric threats. Interested organizations would include DND/CF, other government departments (OGDs), police organizations, non-government organizations (NGOs), industry and institutions (such as banks). Coordination with our allies should also be explored.

Fourth, a joint experimentation capability is identified as essential, including the establishment of a joint experimentation facility. Greater use should be made of advanced technology demonstrators, which includes the use of operational research, the force development client and the requirements client much earlier in the process. These pre-conditions make the process much more suitable for concept development in the 2010 and beyond timeframe. In the same vein, a robust modelling and simulation capability will become a necessity.

Close contact and collaboration should be established with the new USACOM J-9 organization (particularly with the new Joint Battlelab) which is responsible for Joint Experimentation. We need to conduct detailed analysis (including applicability to Canada) of how the U.S. is developing concepts, carrying out experimentation, and implementing the results. An examination of the merits of a DND/CF J-9 like-oganization, focused on the specific mission of the CF, should be undertaken.

Fifth, it is proposed that a CA/US Cooperative Program for Technology, Research and Development be established to increase and focus technology co-operation with the US to facilitate DND/CF preparations for 2010 and beyond. This program would be used to leverage our limited resources with our largest trading partner and likely the lead nation in future coalitions. Canada could position itself to make a valuable and focused contribution to such an effort.

The sixth recommendation is that the exploitation and integration of spaced-based capabilities must be studied and considered for implementation in the CF. The migration of many traditional capabilities, such as communications and surveillance to space, and the continuing enhancement and development of other capabilities demand that spaced-based assets be fully integrated into CF operations and planning. The potential for space capabilities to provide joint support must be maximized.

Seventh, in the area of Materiel Acquisition and Support (MA&S), future support concepts need to be developed that are closely integrated with, and based on, sound operational concepts. Different support paradigms should be explored. DND/CF must put increased emphasis on achieving equipment compatible with its Allies and must increasingly utilize "open" architecture platforms to permit interoperability and growth potential. Steps must be taken to increase confidence and safeguards in contracting with Industry, particularly with respect to its ability to deliver to in-theatre locations and its ability to accommodate "home nation" priority.

DND/CF must aim to tailor the size of the support footprint throughout the supply chain, particularly in-theatre. Consideration should be given to paralleling civilian practices in peacetime but also must have the expansion capacity to provide for a more robust and reliable system in wartime to ensure effective operations and to reduce the risk to deployed forces.

Eighth, the global marketplace is driving change in the industrial sector to the extent that the companies of the future could look much different from their current day counterparts. This profound change will be accelerated by the linkages between the RMA and the Revolution in Business Affairs (RBA). In turn, this will drive the requirement to improve ties between Industry and DND/CF. To that end, existing relationships must be solidified and new ones forged. Our exploration of Material Acquisition and Support indicates that much can be done to improve the end-to-end procurement process. Doing so will benefit Industry as well as the Department. In addition, opportunities exist for Industry to become more actively involved in a new support paradigm and the extent of involvement in this area needs to be actively explored.

Ninth, optimising the role of the human and providing support on the battlefield of the future is critical to the future of DND/CF. Due to the rapidity of information flow in the future, increased emphasis will need to be placed on Science and Technology for facilitating human-human interfaces, human-machine interfaces, and determining the requirement for unmanned platforms.

Tenth, with respect to the Human Resource (HR) changes, there are a number of key recommendations. We have to modernize our HR practices. This requires appropriate policies

enabling DND/CF to attract, develop, lead and retain its members. We must examine flexible methods to attract future members. The training and professional development system needs to be more adaptable to fit the constant changes in required skills and competencies. DND/CF must develop leadership models best suited for an information age environment where communications and decision making will occur at a more rapid pace than ever before. The leadership model must instil a teamwork ethos, as well as support empowerment and responsibility for results at all levels. One avenue to explore to aid retention is the flexibility of movement between the Reserve Force and the Regular Force.

The final key area concerns the entire Canadian Defence Community which must cooperate to the fullest extent to meet the challenges of the future. Thus, maximum advantage must be taken of Canadian expertise in industry, academia and OGDs. Additionally, we must leverage allied efforts wherever possible in order to operate and survive on the battlefields of the future.

Way Ahead

There is much to be done to confront and exploit the RMA. We must develop a strategic plan that builds on our current strengths while also allowing us to take the required steps towards the future. In addition to the items mentioned above, we need to explore battlespace awareness (an interactive picture that gives a timely and accurate assessment of all operations within the battlespace), battlespace knowledge, precision strike, strategic mobility/manoeuvre, protection and battlespace assessment with respect to 2010 and beyond. Major changes are required in doctrine, structure (e.g. a new JFHQ), people (attract, develop, lead and retain), equipment and support. We must encourage experimentation with new concepts and technology.

The following pages of this Concept Paper outline, in considerable detail, ideas and recommendations that together provide a framework through which the Department and the Canadian Forces can embark on an evolving process that will assist DND/CF in successfully meeting future challenges. It is hoped that these ideas and recommendations will generate a dialogue across the organization that encourages a collective and collaborative approach to the future direction of DND/CF.

Chapter 1: The Future Security Environment & the RMA

The Future Security Environment

One of the more striking yet difficult aspects of the past decade, has been the rapid and persistent pace of change. While much of this change has been of a positive nature, there have been developments that should lead us to view the future with a cautious and sceptical eye. It has been suggested that we are in a period of transition, away from the rigid bipolar overlay of the Cold War era towards a new yet uncertain order.

Such uncertainty, in and of itself, renders the task of ensuring adequate levels and forms of military capability for the immediate and longer-term future a challenging one. At the same time, several competing pressures have come together in a fashion that compounds the planning problem. On the one hand, there is an understandable desire to see a "peace dividend". This desire was manifest throughout both the countries comprising the North Atlantic Alliance, and the members of the former Warsaw Pact. In response to this, the past eight years or so have seen significant reductions in armed forces and in defence budgets. On the other hand, there have also been frequent calls for armed forces to deploy abroad on short notice in support of intervention operations, ranging from classical peacekeeping, through more robust peace-making operations, to mid-intensity conflict in the Persian Gulf War.

The world confronts Canada with a complex and complicated strategic picture, made up of a diverse set of smaller, less consequential threats than those posed during the Cold War. There is currently no major power that poses the type of grave risks associated with the Cold War confrontation. The most likely conflicts are also the least threatening. The extent to which this situation continues remains an open question, at least for the time being.

In light of the continued uncertainty and competing pressures on military establishments, the question becomes how armed forces are best able to balance current and future requirements. This is particularly challenging, given that the future cannot be predicted accurately. What is known, at least in the abstract, is that conflict will continue to be a factor in international relations. Armed forces will therefore, still be required, first as a deterrent, and should deterrence fail, then to fight and win in support of the nation's interests.

There is an element of uncertainty attached to this relatively benign, status quo. This situation poses a dichotomy for defence planners. The more optimistic might suggest that balanced military forces designed for large-scale conflict are no longer required, and that armed forces should be specifically tailored for the types of conflicts that are likely to characterise the immediate future. Conversely, the more pessimistic could argue that in ignoring the potential for future large-scale conflict, we are in fact ensuring that it will come at some point, and that we will be unprepared. Hence, the challenge for defence planners is to optimise armed forces to take account of both possibilities.

Given these two possibilities, neither of which can be excluded, the CF are being asked to consider how best to cover both extremes and anything that might fall in between. This will require the CF to ensure a measure of readiness for the current types of conflicts, while at the same time, preparing for a changing strategic environment, one that will bring uncertainties and present new challenges.

Preparing The Canadian Forces for the Future

Understanding the potential dangers to Canadian interests is essential to developing a force structure capable of meeting a diverse set of potential future challenges. While a number of traditional security problems remain of great concern—e.g., the rise of regional hegemons and the threat of local interstate conflict—an array of less well-defined dangers have quickly assumed a new and sometimes prominent place in planning considerations. Among these latter challenges are the proliferation of non-state security threats. These include widespread population dislocations; ethnic and religious conflict; epidemic health problems, famine, and serious environmental degradation; evolving terrorist organizations and agendas; international organised crime in its many dimensions, particularly the still-burgeoning drug trade; and black and gray market weapons trafficking. We will be challenged to address these requirements across the spectrum of conflict.

We will, therefore, need to ensure the continued development of the CF to meet future challenges of both familiar and unanticipated natures. In other words, we will need to balance the types of likely operational deployments in the short to medium term, with the requirement to evolve to meet future challenges.

Given the uncertain nature of future security challenges, it will be necessary to maintain operational flexibility, both for the short and longer term. As a basic premise, then, the CF will require a measure of balance across the operating environments (sea, land and aerospace) as well as multi-purpose character, capable of operating and surviving in a wide range of conflicts and environments.

In developing the force construct to provide this capability we must ensure we recognize the impact of modern technology on the threat to our national interests. Many small nations and terrorist organizations have access to modern weapon systems that are sufficiently powerful to allow a small number of weapons to threaten regional stability and create a significant threat to a deployed force and the Canadian homeland. It is therefore imperative that we maintain a sufficient level of technologically capable forces to operate against these new threats. Therefore, our equipment must be effective, robust and interoperable with our allies.

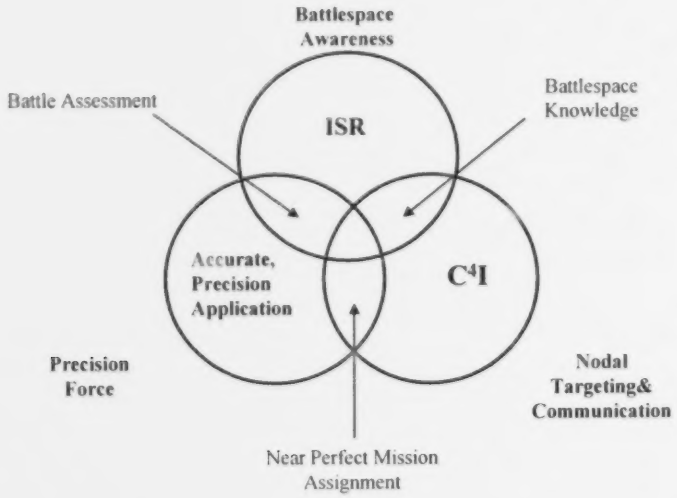
Arguably, the CF has reached the point where continued, across the board incremental reductions are no longer possible. Canada will require Armed Forces that are flexible and with the right capabilities to meet a wide range of possible challenges, and to undertake potentially more diverse operations in support of Canadian interests. In addition, the next decade may well be a test-bed for new operational concepts and success in the future will almost certainly depend on the quality of choices made today. There is scope for significant change, and we must recognize that capabilities needed in the future may well prove to be different than those we currently possess or are planning for. However, in spite of our best efforts, we might miss the

mark in some areas. If we are to prevail, we must have developed the critical capabilities to assess, amend and adapt swiftly. To provide such forces, the CF will need to embrace change, actively pursuing developments in joint force operations, coalition/combined operations, advanced technology trends, and new operational concepts.

The Revolution In Military Affairs

One of these new concepts that has generated considerable interest in military circles is the notion of a Revolution in Military Affairs (RMA). In essence, *a Revolution in Military Affairs is a major change in the nature of warfare brought about by the innovative application of new technologies which, combined with dramatic changes in military doctrine and operational and organizational concepts fundamentally alters the character and conduct of military operations.*

According to this definition an RMA addresses three elements: technological change, doctrinal innovation, and organizational adaptation. In each of these elements, there have been significant advances in recent years. The emergence of information technology and information systems holds out the prospect of dramatically altering command and control of armed forces. Coupled with major advances in precision, lethality, and miniaturization, to name but three, this will alter significantly the way armed forces operate across the spectrum of conflict. Doctrinal and organizational changes currently under consideration seek to capitalize on the technological advances to effectively change the way armed forces would apply force. The figure below portrays this graphically. The intersection of developments in the three spheres represents the point at which an RMA can be said to occur. This diagram illustrates how the integration of the technologies depicted below offer the actual leap in military capabilities. Together these technologies have the potential to apply force more efficiently, effectively and accurately. This fact means that armed forces will better be able to execute their missions with less mass and possibly less casualities on both sides.



The United States and the Revolution In Military Affairs

Presently, it is the United States that has devoted the most time, attention, and resources to exploring the prospects for an RMA. The need to pursue an RMA has been identified explicitly in virtually all high level policy, strategic, force development and doctrinal publications issued by the DoD, the Joint Staff and the individual Services. These reports indicate that the United States will actively seek to build its armed forces in such a way that they can take advantage of the Revolution in Military Affairs.

Whether the United States is successful in its pursuit of an RMA remains to be seen. Some critics have suggested that the cost will be too great, given current and forecast budgetary appropriations. Other critics argue that this will be a futile effort, in that a force modelled to take advantage of the RMA will be vulnerable to relatively low-tech, inexpensive, asymmetric counters. Whatever the final result, it is clear that the US is intent on making the transition. Even if the RMA does not deliver all that its proponents claim, the US armed forces will emerge from the effort with a far flatter structure; a more flexible command and control system; more precise and lethal power projection systems; and, progressive doctrine. The net effect of this effort will be a technologically advanced armed forces to support US interests and objectives. (See Annex C for a detailed discussion of the means by which the United States will implement the RMA.)

Other Allied Approaches to the Revolution in Military Affairs

Britain, France, Germany and Australia are undertaking selected aspects of the United States-led Revolution in Military Affairs (RMA). In thinking about Canada's own approach, it is useful to understand how these countries are responding to the challenges posed by the RMA phenomenon.

Britain and the RMA

Over the past few years Britain has undertaken several measures that are consistent with the RMA. Many of these are being advanced by the July 1998 *Strategic Defence Review* (SDR) which emphasises improving Britain's capabilities in the areas of intelligence, surveillance and reconnaissance, as well as command, control and communications. Britain is looking to unmanned aerial vehicles (UAVs) for surveillance, as well as to airborne radar aircraft. For command and control, it is focusing on technologies that enable it to work effectively in multinational operations.

Britain is creating expeditionary forces for power projection in peacekeeping and peace enforcement operations. Part of this process is an increase in strategic lift capabilities, including new transport aircraft and roll-on/roll-off container vessels. The Army's rapid deployment capability is being improved by restructuring its units into more flexible, mobile brigades. Britain is creating a Joint Rapid Reaction Force using units from all three services. It is to be under joint command and control, draw on joint intelligence capabilities and have joint logistics. To increase the firepower and mobility of Army units, Britain is acquiring precision-guided munitions. The Royal Navy is focusing on littoral warfare and force projection in support of

land operations. Its nuclear powered attack submarine force is being reduced and equipped with land attack cruise missiles.

The SDR signals a shift towards a more highly trained professional force. Although Britain's regular force will remain at essentially constant levels (with a modest increase in the British Army's regular strength), the Territorial Army will be cut by more than 25%. Remaining Territorial Army units are to be fully manned, trained and equipped to the standards needed to be quickly incorporated into regular force elements.

France and the RMA

France has set in train significant changes in its military system that are consistent with theories about the RMA. The most dramatic is the decision to eliminate conscription and professionalize the French Armed Forces. As part of the professionalization process, the French military is undergoing a significant force level reduction, reserve brigades and regiments are being disbanded, and reservists are being trained to augment regular force units as individuals, rather than units. In addition, the French Army is being reorganized around four forces: one armoured force, one mechanized force, one rapid intervention armoured force and one infantry assault force. The new organization will permit the constitution of modules of different sizes that can be brought together in varying combinations depending on the circumstances. This notion of modularity extends to the other services, with the idea of creating a versatile force capable of joint tailoring and combined operations.

France is creating a Rapid Action Force of between 50,000 and 60,000 troops to be quickly deployable around the world. Establishing the force involves not only professionalizing and reorganizing the military but also furnishing units with new, lighter, more advanced and lethal equipment. Major items include new tanks, armoured infantry fighting vehicles, attack helicopters, anti-tank missiles and helicopter-borne radar. France is also focusing on ensuring interoperability among its services and with its allies. Key to this process is acquiring advanced, interoperable command and control capabilities. The Army is creating a Joint Command Headquarters able to take command of French or Allied forces.

In the area of technology, France is placing primary emphasis on improving its intelligence, surveillance and reconnaissance capabilities with satellites and UAVs. It is also carrying out a process, similar to that of the United States, of digitalizing its Army. Moreover, France has shown significant interest in stand-off precision strike systems and has placed them among its highest equipment priorities.

Germany and the RMA

Over the past few years Germany has undertaken measures that are consistent with RMA trends. Technologically, Germany is focusing on advanced intelligence, surveillance and reconnaissance systems, especially unmanned reconnaissance aircraft.

Doctrinally, Germany has created a Crisis Reaction Force of about 50,000 troops organized from units of all three services to participate in international crisis management

activities. To increase troop mobility Germany is acquiring new, lighter combat vehicles with greater firepower and survivability, and additional strategic transport aircraft.

Part of Germany's move towards an expeditionary warfare capability involves a significant reduction in the size of its forces. In contrast to the more common organizational trends of the RMA, Germany plans to retain its system of universal conscription. That said, by the year 2000, sixty percent of Germany's military will be volunteer and the rapid reaction force will be manned entirely by professional forces.

Australia and the RMA

Australia is making a conscious effort to focus on the RMA, particularly as it relates to working with the United States. *Australia's Strategic Policy* (December 1997) places the RMA at the top the Australian Defence Force's structure development priorities. Australia is improving its access to space-based surveillance capabilities and acquiring long-endurance unmanned aerial vehicles. It has undertaken a major, 15-year program to harmonize various service efforts in the fields of command, control, communications, surveillance and intelligence collection. Australia is also focusing on precision weapon technology, acquiring long-range stand-off strike weapons for its strike aircraft.

Australia is creating more rapidly mobile and flexible ground forces equipped with advanced munitions and platforms. *An Australian Army for the 21st Century* outlines a new task force structure for the Australian Army made up of combat units embedded with greater mobility, precision firepower, and advanced sensors. Mobility is to be enhanced with helicopters for troop lift and new, lighter armoured vehicles with improved cross-country mobility. The task forces are being designed to operate jointly with the combat elements of the other services.

Canada and the RMA

Canada must have the ability to operate across the spectrum of conflict. The Revolution in Military Affairs affects part of that spectrum. For the Canadian Forces, the implications of the RMA may be profound and significant. Even though the idea of a Revolution in Military Affairs is not new, the process of transformation can be traumatic, particularly for the existing military hierarchy. To a certain extent, this is understandable. For compelling reasons, militaries are intensely conservative. The cost of failure is paid in blood and treasure, hence the reluctance to embrace new and untested ideas. Yet, at the same time, the failure to adapt can be similarly costly.

In the current discussion of a Revolution in Military Affairs, we may find ourselves at one of those unsettling moments in history where change, however painful, is required. The challenge then, is to determine how we should respond to the promise, however vague, held out by new technology. At its most basic level, the problem is really one of understanding the relationship between the theory of the Revolution in Military Affairs, and the reality of a doctrine that gives power to the theory. If the Canadian Forces are to remain relevant and salient, they need to keep pace with developments in the science of war. The CF needs a vision of what modern war will be like in the year 2020 and a plan for how we will get there.

Chapter 2: Operations

Background

Future warfare is characterized by rapidly emerging technologies and uncertainty. The combination of these elements makes planning for the future difficult at best. Yet, to remain relevant in today and tomorrow's defence environment DND/CF should broadly think about and develop conceptual plans for the future, and this should be followed by experimentation to validate these concepts. Since Canada's most important ally—the U.S.—is fully engaged in the pursuit of the RMA, DND/CF must strive to understand its implications. A thorough examination of the benefits and risks of the RMA will allow us to judiciously incorporate technological, doctrinal and organizational changes deemed most beneficial while enabling us to avoid areas of limited value.

It is evident that new trends in warfare should be examined initially and closely by those most affected by them. While other environments within the Department need to explore the RMA, they need to do so with knowledge of how the CF and its three fighting elements — Maritime, Land and Air —view the RMA. Although the individual service elements have not yet articulated what the RMA means to them, the findings put forth in this chapter are meant to provide an overarching framework for any decisions that the Department and the Forces make in terms of the RMA. A clear understanding of the future needs and plans of the elements will enable senior management in DND/CF, our industrial partners and others to best support Canada's men and women in uniform as they work to secure our nation's defence.

Confronting the Future Security Environment

The trends that characterize the future security environment (discussed in Chapter 1) demonstrate the requirement for the CF to continue to evolve in a manner that supports our fundamental national interests. To accomplish this objective, it is necessary to develop a vision that will carry the CF through the next twenty years such as Defence Strategy 2020. The basis for this is the need to create a combat capable, rapidly deployable force able to operate effectively with our major allies in the single integrated battlespace concept of the 21st century. In charting this concept for the development of the CF, there are several key considerations.

Combat Capable Forces: The first is the notion of combat capable forces. Armed Forces are the last resort for the nation in support of its interests, both at home and abroad. Therefore, they must be capable of the application of salient combat power if and when called upon.

Operate Effectively with our Allies: A second notion is the requirement to operate effectively with our major allies. Canada will continue to pursue its interests in conjunction with allies and in coalitions. It will therefore, be incumbent upon the CF to develop adapted structures and capabilities.

A Meaningful Contribution: We can not assume that the injection of a symbolic presence into future operations will afford us operational influence. It will not. Operational influence, which in turn translates into international influence, demands that Canada continues to contribute a relevant force where it chooses to make a military commitment. If Canada expects to exercise influence within the alliances and organizations to which it belongs, salient and relevant force contributions to future operations are a must. Recognizing that we cannot deploy numerically large forces, we must guarantee salience through providing relevant forces that have a high level of training, professional competence and equipment that is equal to or better than Canada's coalition partners.

An issue that must be borne in mind in considering any future force structure is the threat posed by asymmetric warfare. As armed forces become more technologically based (and expensive) their adversaries may make greater use of asymmetric means than they do today. It is anticipated that the ability to disseminate, process and act upon information will become increasingly important to the functioning of militaries, therefore, DND/CF should develop methods and policies to deal with information attacks and espionage. Canada needs to develop a national vision for our nation's security to defend against the growing number of asymmetric threats to our people and infrastructure.

Finally, the CF must take account of the transformations currently underway in the art and science of war. War will no longer be the sequential application of massed force by separate services. Rather, war is being transformed into what has become known as the single integrated battlespace concept. The CF must ensure that in developing itself for the future, it does so in a manner that will allow it to operate in this new battlefield environment.

These considerations, taken together, constitute a vision of the environment in which the CF will operate in 2010 and beyond. In order to translate this vision into reality, it will be necessary to develop a plan to ensure that the CF is able to take the necessary innovative steps that will successfully transform it into a relevant force for 2010 and beyond. This chapter aims to offer a framework for the development of a plan for the " future operations" side of the equation.

Assumptions

This chapter's development is grounded in assumptions that directly impact the parameters within which changes and recommendations are considered. These assumptions include the belief that if funding for DND/CF remains relatively static, then the present ratio of defence spending allocated to capital procurement is inadequate and will lead to "rust-out."

This chapter's recommendations and conclusions, as well as those of the paper in total, should assist in developing suggestions that address this danger of "rust-out" and the need to examine the scale of effort required to execute DND/CF's missions. By grounding these findings in an examination and understanding of the RMA, the Department and the CF can better allocate resources to doctrinal, organizational and technological changes to ensure Canada meets its present and future defence needs.

Attributes

In considering the doctrine, organization and technology that will best position DND/CF for the future, there are a number of desirable attributes that we will wish to retain, or to develop further. These include, but are not limited to:

- **Flexibility** -- The future security environment (FSE) is presently unclear and will remain so. The FSE's opaqueness and probability of spanning a diverse range of security situations demands that we incorporate flexibility into our force structure, our thinking, planning and procurement processes;

- **Adaptability** -- Tied to the need for flexibility, DND/CF must ensure that we encourage all areas of the Department and Forces to willingly adapt their resources, people and methods to changing domestic and international situations while keeping up with today's swift pace of technological evolution;

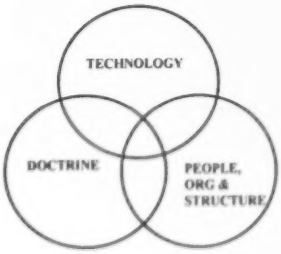
- **Interoperability** -- (Joint and Combined) – As today's international environment and concomitant security threats lend themselves to coalition operations, Canada's defence forces must remain interoperable with our major allies, especially the U.S. The single integrated battlespace concept of the RMA greatly heightens this need for interoperability;

- **Robust** – DND/CF must strive to field defence forces that are robust in nature. This present analysis of the RMA will better enable us to identify and leverage those areas that will contribute to bolstering the CF's strength while also identifying vulnerabilities prior to their exploitation by an enemy;

- **Relevant** – Embedding the four characteristics mentioned above in our future force structure will enable Canada to field a defence force that is relevant to our security needs and to the demands of our alliance and coalition responsibilities. DND/CF's, and more importantly our nation's, credibility is tied to our actual and perceived relevance.

Lines of Investigation

In examining how the RMA might impact DND/CF, this chapter has been organized along three lines of investigation: Doctrine, Organization and Technology. This approach is beneficial to studying the way ahead in that it underscores how the RMA can impact a military's doctrine and subsequently its organization and technological needs. These three lines of investigation, properly integrated, offer a balanced force able to address Canada's future defence needs. This construct is depicted in the figure on the following page.



Organization:

Human Resource Implications: To achieve the attributes outlined in the previous section, DND/CF will need to consider the type of individuals it requires. CF personnel will have to be well trained and educated. They will need to be flexible in their job and willing to tackle new duties and engage in ongoing education. New operational models will require them to acquire new operational skill-sets. Increased operational tempo on the future battlefield will require individuals who are able to process vast amounts of data and make quick decisions based on that data. In short, the military professional of tomorrow will need to be multi-skilled and willing to constantly upgrade those skills. The human resource implications will be discussed in detail in Chapter 6.

Material Acquisition and Support: In the future, deployed forces will have to be sustained by an adaptable and efficient logistics system. In order to do this, these forces will have to be directed by a central command system that is proactive, anticipating the needs of its charges, and fully interoperable with its allied partners.

When planning future upgrades and acquisitions, DND/CF should consider program buying instead of project buying as this would allow for better capital planning, and it would strengthen relationships with industry. Such a scheme would provide work over a number of years, and enable a greater degree of flexibility for planned upgrades. Programmed acquisition would also allow for a better cycling of equipment from the Regular Forces to the Reserves. New approaches to material acquisition and support are presented in detail in Chapter 4.

Industry: In the future we will have to extract maximum benefit from our defence industrial partners. A new relationship may allow much more substantial fiscal input to DND/CF projects and programs, however, we have to be cognizant of the commitment that industry will expect from the Department under such innovative arrangements. Industry/Defence interdependencies are explored in greater detail in Chapter 5.

Technology:

While DND/CF now possess a number of platforms, weapons systems and sensors that are state-of-the-art, the rapid pace of technology demands that we not become complacent about our equipment. Although we may not choose to replace all existing equipment, we must be ever vigilant to emerging technologies that have the potential to augment our present capabilities. In doing this we must seek to ensure, through experimentation, that all future purchases of equipment and technology complement and enhance our force design.

To maximize the CF's strength and relevance, future equipment must be technologically current when it enters the inventory. In designing and building future defence forces, we must acquire sensors that are able to provide accurate, timely information in near real time. We must purchase weapons systems that offer both the best protection for our personnel and deliver effect on time and on target. These systems must be relevant to our force structure and capable of meeting our needs across the spectrum of conflict. This will require an investigation into the full integration of spaced based capabilities. Space capability is key today and vital to the future operational effectiveness of the CF and it will provide the backbone of knowledge based warfare and situational awareness that enables the concept of the single integrated battlespace. We must fully integrate space into CF doctrine, capabilities and operations to be relevant and effective in the 2010 and beyond environment. These issues and the role of science and technology in preparing DND/CF for the future is examined in Chapter 3.

To arrive at the best mix of equipment, DND/CF must engage in joint experimentation nationally and internationally (i.e., with our allies). In acquiring new equipment and technologies we should determine ways we can leverage its inclusion in coalition operations. While not necessarily looking to provide niche forces to future operations, we should nonetheless consider what in our force structure would best enhance the capabilities of assembled coalition forces, as well as give us the profile and salience we desire.

Doctrine:

Specific changes to present warfighting doctrine will only follow a thorough analysis of how the RMA and other future defence trends impact DND/CF. Through this paper and the recommended follow-on activity, a clearer understanding of exactly what the RMA means to DND/CF should emerge allowing for an informed re-examination of doctrine.

RMA Team & Experimentation

The development of structures necessary to achieve a relevant future defence force requires that a number of steps be taken to move forward. The first of these steps is experimentation. Yet, before we invest resources in experimentation we need to devote time to thinking. A logical starting point, then, would be the creation of a group of military and civilian personnel dedicated to this task. The Australian Defence Force has adopted this approach for dealing with the RMA phenomenon. The fact that they have named a Brigadier-General to head their team indicates the emphasis they are placing on this issue. Canada should parallel this approach. This group would be responsible both for investigating RMA/future defence trends

and suggesting possible courses of action for DND/CF in their pursuit of the future. Included in the recommendations would be direction on experimentation.

Through directed experimentation we could cost effectively test doctrine, organization and new technologies, thereby ensuring that we achieve the best balance and remain true to our defence mandate. Thinking and experimentation will allow us to determine the most advantageous force structure in terms of our budget, responsibilities and the future security environment. Experimentation will also enable us to study effectively and prepare defences against asymmetric threats.

When considering experimentation we should explore its options in terms of participating in joint experiments with US and other coalition forces. Through multi-national experiments Canada can benefit from utilizing the resources our allies possess, will learn from the work that they have done to date, and can leverage its areas of expertise during participation. When engaging in joint experiments with the US or other allied forces, we must remain mindful of our priorities and requirements so as not to adapt our doctrine or equipment to roles that suit our allies but not ourselves.

Conclusion

In carrying out the necessary follow-on work, we must bear in mind the need to achieve the proper balance between doctrine, organization and technology. This chapter is intended to introduce areas that need further analysis and provide a list of recommendations to guide DND/CF through the process of follow-on exploration.

Summary of Recommendations:

1. DND/CF must continue to explore the RMA issue and prepare to exploit the opportunities that arise from this examination.

2. DND/CF must ensure that its three fighting elements are interoperable and capable of operating effectively within an alliance.

3. A dedicated working group led by a Flag/General officer should be formed to study RMA related defence trends. The group's membership would include persons from the three services, the S&T, MA&S, Industry and HR communities. This group would report their findings to the VCDS and suggest possible avenues of implementation.

4. DND/CF must make a commitment to joint experimentation because this is the most efficient method for the Forces to develop their doctrine and organization to meet Canada's future defence needs. To this end, there is much to be learned from our allies particularly from organizations such as the new US J-9 (experimentation) organization. DND/CF should actively pursue the development of a Canadian joint experimentation centre.

5. Due to the implications of the Future Security Environment, Canada must re-examine its present policy and commitment of resources with respect to the space milieu. DND/CF must ensure that emerging space-based capabilities are properly exploited despite the current lack of service sponsorship or space vision.

6. Changes to current CF doctrine will need to be considered once the implications of the RMA issue are fully understood within DND/CF.

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Chapter 3: Science & Technology

The Changing Context for Defence S&T

The context for defence S&T has switched from the Cold War as the driver for defence planning, threat-based force planning and growing defence S&T investment. Today the Spectrum of Conflict is the driver in Defence planning; the RMA is being hotly debated and advanced; we have capability-based planning and we have significantly reduced Defence S&T investment. The way ahead will see an even greater shift in the defence S&T context and this will affect the way in which all components of DND carry out their responsibilities, including those involved in the science and technology area. An especially challenging aspect is that the civil-sector leads some technologies that are critical for the future. Thus, more than ever before, the Defence S&T Community will need strong collaborative bonds with the civil sector in order to advance and integrate these militarily relevant technologies.

A key component of the 2010 and beyond Defence S&T context will be the Integrated Single Battlespace. This will be characterised by a high degree of jointness, interoperability and speed of information flow made possible by rapidly advancing, integrated technologies. Effective S&T preparations for 2010 and beyond will require stronger collaboration on many levels with our allies to facilitate interoperability. The features of the 2010 and Beyond Defence context for Canada indicates a very strong requirement for the S&T Community to form an even stronger team with the rest of the Department in order to achieve the collaboration, the focussed effort, and the enthusiasm required to build a modern, survivable and effective future defence force.

S&T Implications of the Single Battlespace

The UK Strategic Defence Review expects that by 2015 military operations will no longer be characterised as land, sea or air. There will instead be a single battlespace in which land, maritime and air forces will be directed, targeted and supplemented by a new generation of intelligence, surveillance, information and communications systems offering a step change in military capability. Operationally, the single battlespace implies a much larger volume (or area of operations), growing dependence on space-based assets, compressed time lines and many actors. All this implies the requirement for a high degree of interoperability.

The S&T community will need to integrate its future program much more closely with the rest of the Department. Since the future single battlespace will be enabled by rapidly advancing technologies which need to be integrated with new concepts in doctrine and organization, it then becomes critical to establish Departmental objectives in S&T which have been developed in close cooperation with those responsible for new doctrine and organization, as well as with other key players. These Departmental S&T objectives must be examined and adjusted periodically as concepts in organization, doctrine, and technology develop further.

The S&T community itself will need to efficiently integrate its efforts on equipment, systems, and information required for the 2010 and beyond single battlespace. Equipment systems for the single battlespace will be highly integrated. This is exemplified by the US

concept of an overarching integrated C^4ISR system (command, control, communications, computers, intelligence, surveillance and reconnaissance). Thus, the S&T community will need to ensure that its efforts and assets are efficiently focussed on joint objectives and that there is no duplication of work for the army, air, and navy components. When appropriate, the S&T community needs to be proactive in pointing out opportunities for S&T work, which would jointly benefit all three (or two) components. This will help ensure that, where required for the single battlespace, future systems are "born joint." The S&T community must cooperate much more closely with our allies on S&T for future systems intended for use in the single battlespace.

The S&T community must cooperate much more closely with the Canadian industry and academic communities (as well as OGDs) on S&T for the single battlespace. The advancing technologies that are transforming countries such as Canada from industrial to information societies are being led by industry. Expertise relevant to 2010 and beyond also exists in the academic community and in other government departments. This makes it essential for the DND S&T community to not only advance technologies mainly of interest to DND but to also adapt technologies being advanced by industry and other S&T performers for use by the CF.

S&T and Interoperability

Interoperability will be an essential requirement in order to survive in the integrated single battlespace. Joint/Combined Task Force operations of 2010 and beyond will require interoperability across the complete spectrum of operations (involving operations now designated as land, air and sea). Thus, the CF components (or modular units) must be interoperable with the components of the Joint Combined Task force including all Canadian components. The key point to address is future interoperability. That is, the ability of the CF to be interoperable within itself and with its allies as new equipment systems incorporating advanced, integrated technologies are introduced, along with new concepts in doctrine and organization.

The S&T community must play an integral role in the systematic DND wide approach which must be taken towards future interoperability. The S&T Community can assist in projecting the departmental scenarios forward to establish future required capabilities and what S&T needs to be done to bring about these capabilities. It is essential that interoperability between the components of the CF be considered from the beginning. It is particularly important that those working on future concepts in doctrine and organization work closely with those responsible for establishing the future direction of DND S&T.

The S&T Community must play an important role in ensuring that the CF is interoperable with its allies in future Joint Combined Task Force operations. The Canadian S&T community has a long history of successful leveraging with the S&T communities of our allies. Once Canada's role in the Joint Combined Task Forces of 2010 and beyond have been established, international S&T cooperative agreements can be used to achieve agreement on standards which affect interoperability. Interoperability problems can also be identified through the use of technology demonstrators and simulation and modelling for acquisition, mission rehearsal, and training (these topics are discussed further below).

S&T and Asymmetric Threat Protection

DND's S&T and analysis (including intelligence) response to asymmetric threats must be more closely coordinated to maximize use of the available resources devoted to this area. This is one area where DND must develop niche areas in which it can excel and use this expertise to leverage with its allies. It is recommended that asymmetric threat expertise prioritisation be more strongly coordinated within DND. Key players would be the S&T, Intelligence and the Operational Communities.

Thought should be given to the establishment of a national infrastructure vulnerability centre. Identification of and protection against information operations (actions taken to affect adversary information systems), terrorism, international organised criminal activities and other ways of attacking infrastructure are of concern to a large number of organizations outside of DND including industry and institutions (such as banks), police organizations, and other government departments. Because of the complexity of the threat, a national infrastructure vulnerability centre may be the most effective way to organise Canada's response to asymmetric threats.

A pro-active approach to asymmetric threat coordination with our close allies should be taken, including the establishment of a sub-committee under the bilateral CA/US Military Cooperation Committee and a joint S&T/Intelligence panel reporting to The Technological Cooperation Program, Non-Atomic Military Research and Development (CA, US, UK, AS, and NZ) principals. Because of the wide scope of the asymmetric threat problem, it is thought that direct leveraging of resources should take place through organizations which have proven to be the most effective over the years. Leveraging should be with those allies with whom we would most likely fight in Joint Combined Task Forces in the 2010 and beyond time frame. These are also the allies that are the most positive towards establishing the capabilities required for an RMA force.

Mechanisms for Integrating S&T with Doctrinal and Organizational Concepts

Since the ultimate objective of the RMA is the concept of a single integrated battlespace involving a new generation of integrated information, sensor and reconnaissance systems, the only way for DND to approach 2010 and beyond is to integrate as closely as possible the work required to develop, experiment with and implement new concepts in S&T, doctrine and organization. Considerable change will need to take place to achieve the ability to integrate new concepts in organization, doctrine and technology. There is no doubt that this can only be done with the full support of top DND management and in a forward looking atmosphere in which free thinking, conceptualisation, and a strong corporate approach are highly valued. Most important is the creation of a non-judgemental atmosphere in which mistakes or poor results are valued for what can be learned from them. A comprehensive approach which de-emphasizes stovepiping, emphasises corporate sharing of information and emphasizes removal of duplication in the current stovepipes is required.

The new Network of Defence Partners in Science and Technology must play a key role in the integration of S&T with new doctrinal and organizational concepts. This is the body which brings together the S&T expertise within DND. A sub-committee, reporting to the Network (which meets twice a year) could be responsible for implementing concept integration and experimentation. This sub-committee would need to work very closely with those responsible for experimentation with concepts (perhaps a new Joint Experimentation Centre).

Mechanisms for Experimenting with and Validating 2010 and beyond Concepts

New concepts should not be implemented without subjecting them to vigorous scrutiny, analysis and experimentation. The next decade promises to be a time of change and it is critical to establish modern tools and procedures for experimenting and validating the new concepts. A process for concept development, experimentation (both simulated and real-world), assessment and implementation needs to be developed. The establishment of a focused capability in SMART (Simulation and Modelling for Acquisition, (Mission) Rehearsal, and Training) is essential for a coherent approach to 2010 and beyond. The job of determining exactly what SMART can do and what parts of it should be established to assist DND in its concept development, integration, experimentation and implementation stage should be undertaken on a high priority basis by the Network of Defence Partners in Science and Technology. Validation and refinement of requirements need to be fully integrated with the acquisition process. SMART should also be focussed on combined operations (need to develop a Common Operational Picture [COP]). Co-ordination and leveraging with our allies in the application, analysis, and interpretation of SMART is essential, particularly with the US. Close ties should be established with the new USACOM J-9 organization (including their new Joint Battlelab) responsible for Joint Experimentation.

The Technology Demonstrator approach must be used to a much greater degree. It is essential to drastically improve cycle times for fielding new equipment. The old approach of establishment of requirements, XDM, ADM, EDM (Experimental, Advanced, and Engineering Development Model) and then procurement simply takes too long and is inappropriate in a time of rapid change and concept evaluation. Much greater use should be made of technology demonstrators which involves the use of operational research, the force development client and the requirements client much earlier in the process and is much more suitable for concept exploration. It is also a process whereby projects can be modified or closed down earlier if required, thus saving precious resources. Collaboration with our allies is essential whenever appropriate. Technology demonstrators are particularly effective when systems integration is involved, which will be a greater requirement than ever for 2010 and beyond systems.

The establishment of a joint experimentation facility is essential to increase the operator/scientist interface. This is a very effective way to involve the operator in the S&T process and ensure that there is a two way flow of information during concept development and the S&T required to field advanced, integrated systems. A Joint Experimentation Centre could also ensure the human is properly taken into account in the development of doctrinal concepts and systems for 2010 and beyond.

S&T for Optimising the Role of the Human

S&T to optimise the role of the human is an important part of the current DND S&T program and will be needed to address the issues associated with the human operating in the 2010 and beyond security environment. Because of the amount of information available from the integrated systems of the future single battlespace and the high tempo of operations, considerable effort will need to be devoted to ensure that the human-in-the-loop does not become the "weak link" or limiting factor.

Increased emphasis will need to be placed on S&T for assisting commanders with decision making. Thus, to the greatest degree possible, data must be presented in a perceptual (vs cognitive) manner in order to minimise information overload and speed up the decision-making process. New technology should be used to automate decision processes while ensuring that there is a human-in-the-loop. In fact, one area of research will consist of determining to what extent the human should be involved in the decision-making process. There is little doubt that as advancing information and sensor technologies are integrated into operations, issues related to the human-in-command and leadership will need to be addressed. One question concerns the level and consequences of error that we are willing to accept with increasing automation of decision making (risk management). In order to optimise reaction time, consideration will need to be given to the making of a greater number of decisions at a lower level in the chain of command. Alternatively, the 2010 and beyond information and sensor technologies will make it possible for commanders to micro-manage. Hopefully, the new concepts in doctrine will not allow this.

S&T effort will need to be devoted to the support of the human in the single battlespace of the future. The psychological, physical and environmental support needed in 2010 and beyond will have to be addressed. The degree to which cultural differences should be taken into account in combined operations (implicit vs explicit commands) must be addressed.

S&T needs to be carried out to determine the degree to which the platforms and systems of 2010 and beyond should be tailored to optimise the man-machine overall performance. In the past, the operator was often considered as an afterthought. This meant choosing operators with specific features and strength. In the future, systems must be designed to be much more user friendly in order to optimise overall effectiveness.

The S&T community must assess and analyse the role of the human in the single battlespace of the future. There is a clear trend for increasing use of autonomous systems for surveillance, reconnaissance and weapons delivery. The degree to which there should be a human-in-the-loop in all offensive lethal operations must be determined. The degree to which humans can or should be replaced in the platforms of the future is an area that needs to be examined in detail by those responsible for developing 2010 and beyond concepts in doctrine, technology, and organization.

Focussed S&T Collaboration for 2010 and beyond with the US

It is proposed that a program (CA/US Cooperative Program for Technology, Research and Development) be established which will increase and focus technology cooperation with the US DoD to facilitate DND/CF modernisation and promote the formation of a modern force, appropriate to Canada, based on quality. An important component will be Technology Demonstrators of direct importance and relevance to Canada's strategic aims.

There are a number of strategic imperatives that lead directly to this proposed program. First, just as our key allies are doing, DND/CF needs to address the changing nature of war being designated as the Revolution in Military Affairs (RMA). In order to modernise and invest in capabilities that exploit the RMA, we need maximum leveraging of our limited resources. The US is the obvious partner for this proposed cooperative program. The US is our closest ally with whom we have a unique relationship. Interoperability with the US is a military priority. There is also no doubt that the US will lead coalition operations in which Canada will take part. DND/CF's relative size (compared to the US) will allow us to provide a valuable, focussed contribution to this proposed effort. The program must be focused on opportunities that exploit Canada's strengths and serve Canada's strategic aims.

Although this proposed program will address a considerable number of goals, four specific goals are the most critical:

- To contribute to optimum interoperability with the US;
- To cost-effectively and more rapidly meet future CF operational requirements;
- To promote the development of a strengthened Canadian technology industrial base with globally-competitive niche areas; and
- To enhance CA/US relations through technology collaboration.

It is proposed that a working group be established and tasked with facilitating project proposals, coordination, project review and reporting. CRAD, DGIIP, DGSP, the Network of Defence Partners in Science and Technology, representatives of the Elements, and the EPMs would be directly involved in the program.

This proposal is not only consistent with but critical to DND/CF's short, medium and long term objectives. It is consistent with and will facilitate the Defence Management Committee's developing strategic direction and objectives. It offers excellent leveraging of limited resources with our closest ally with whom we share North America. It advances interoperability with the US, which has been stated to be our number one military priority. This program will enhance the Canadian Defence technology industrial base and help it develop increased global competitiveness in niche areas. It offers speedier CF access to advanced technologies required to enhance our selected competencies and fill our identified gaps. Very significant cost savings will result through collaborative technology insertion and by considerably focussing the front end of the capital programs that will be established as 2020 approaches.

Changing the S&T Program for Maximum Effectiveness For 2010 and Beyond

The Defence Research and Development Branch has been carrying out an extensive study of the R&D program that would meet the strategic requirements of DND for 2010 and beyond. Implementation of this proposed program would require considerable changes in emphasis in a number of areas. The proposed program will concentrate on the following eight activities. The activities shown below, which are all critical to an RMA environment, will either be created or significantly increased from current levels. All other activities will be closely examined and refocused if required to ensure optimum relevance to the future force. Client input to this future program will be sought.

- Human Factors Engineering
- Human Performance and Behaviour
- Autonomous Intelligent Systems
- Signature Management
- Knowledge Management
- Information Warfare
- Simulation & Modelling for Acquisition, Rehearsal and Training
- Systems Concepts and Analysis

Summary of Recommendations for DND's S&T Approach to 2010 and Beyond

1. It is proposed that a CA/US Cooperative Program for Technology, Research and Development be established to increase and focus technology cooperation with our closest ally to facilitate DND/CF preparations for 2010 and beyond.

2. A national infrastructure vulnerability centre should be established to coordinate Canada's response to asymmetric threats. Interested organizations would include DND, industry, institutions (such as banks), police organizations and other government departments.

3. The asymmetric threat is considerable and it will require dedicated national resources and close cooperation with international partners.

4. The S&T community must ensure that the future S&T program is closely integrated with the Departments goals and objectives. This will help to ensure that the required level of coordination is achieved between doctrine, organization and technology resulting in the desired degree of interoperability among CF components and with our allies.

5. Much greater use should be made of technology demonstrators which involves the use of operational research, the force development client and the requirements client much earlier in the process and is much more suitable for concept development for 2010 and beyond.

6. The S&T community must cooperate with the wider defence community at home and abroad. Maximum advantage must be obtained from international agreements and nationally we must take advantage of Canadian expertise in industry, academia and other government departments.

7. The new DND Network of Defence Partners in Science and Technology should play a key role in the integration of S&T with new doctrinal and organizational concepts for 2010 and beyond.

8. A robust modelling and simulation capability will be a necessity to deal with the 2010 and beyond environment

9. Increased emphasis will need to be placed on S&T for assisting 2010 and beyond commanders with decision making, which will often be made at lower levels.

10. A high priority should be placed on S&T for support of the human in the 2010 and beyond environment (psychological, physical and environmental), optimization of the man-machine overall performance, and a degree to which humans should be replaced in the platforms of the future.

Chapter 4: Material Acquisition & Support

Challenges Posed by the RMA to MA&S

The way in which the DND/CF acquires and supports its equipment and materiel may be impacted significantly by the RMA. Of the many aspects of the RMA phenomenon, there are four which are expected to have the greatest impact on the delivery of Materiel, Acquisition and Support (MA&S) in the future. These include: increased complexity of weapons systems technology; increased pace of technological change; expansion of the battlespace; and increased availability of information.

The new weapon and information technologies available offer superior fighting capability but at significant acquisition and life cycle sustainment costs. These costs are related to both hardware and software components of the new systems. Even though in many cases the newer equipment is more reliable, when it does break it is more costly to repair since sophisticated electronic components replace simpler mechanical parts and more highly trained technicians are required to correct malfunctioning equipment. Further, more costly equipment is needed to diagnose problems and higher level assemblies are replaced instead of component parts, again adding to the support bill. Overall, it will be of primary importance to balance the upgrade costs of equipment against the replacement costs to determine when it is most cost effective, and technically viable, to replace the equipment, rather than repair it.

A second aspect of the RMA phenomenon that poses challenges to MA&S is the speed of technological change, again both for the initial acquisition and the on-going support. By the time the operational need is defined in a traditional specification, the technology has moved on leaving behind an obsolete document that would be subjected to continual amendment in the attempt to define what the government is contracting for. Solutions such as the adoption of contracting techniques which eliminate/reduce the need for specification writing will help somewhat with the initial acquisition, but the thornier support implications remain. Shortly after the equipment is delivered, a newer version/upgrade will be available. To combat this, the use of "incremental acquisitioning", rapid prototyping, and modelling and simulation, also referred to as "technology insertion" must be introduced. The need to upgrade our equipment is required, both from an operational perspective which demands inter-operability with our allies and superior effectiveness against potential adversaries, and also from a cost effectiveness point of view, given spare older models, or parts for them, quickly become hard and expensive to obtain. The need to establish common architectures, and a building-block approach to maintaining and enhancing equipment, will be paramount. As well, once the most cost effective approach has been carefully assessed, there must be flexibility in the funding, between both "votes" and fiscal years.

MA&S delivery in-theatre will change in response to the expansion of the future battlespace. With potentially fewer personnel in theatre, the support footprint will also have to shrink—even though the range of functionality and requirement for support of equipment may remain the same or even increase. Support organizations will provide the required level of service from a greater distance. This will imply not only different support approaches in theatre,

but also in preventive maintenance programs. As well, these different support approaches will demand different skill sets of the individuals responsible for their implementation.

Increased availability of information will offer MA&S providers the ability to tailor support more effectively and respond more quickly to changing needs as the operational situation evolves. By "seeing" the operational situation, they will be able to anticipate needs and have the required support in place. Similarly, access to usage rates, failure rates and other such equipment data will facilitate trend analysis leading to earlier identification of problems and corrective measures. Information from many sources must be synthesized in real time in order to produce such meaningful decision support tools.

Potential Strategies for MA&S Delivery

Given the challenges posed to the MA&S process by the RMA, the central question that must be asked is "How do we structure the support framework to be most responsive to the future operational requirements?" A number of complementary strategies are possible, and should be considered, in order to achieve the necessary robust and reliable blend of support functions. Some of these are detailed below.

Partnering with allies. Canada's allies are a potential source of MA&S. There are a number of different "partnering" arrangements possible including:

- host nation support negotiated either on a bilateral basis or as part of a multi-nation agreement (UN peacekeeping operations);
- direct provision of services/goods by allied forces;
- shared contractor support negotiated by allied forces;
- reliance upon foreign industry, which was possibly the original equipment manufacturer (OEM), for support and evolution of large weapon systems;
- lend/lease type arrangements whereby Canada "buys" operating hours, training and maintenance on certain types of allied owned specialized equipment; and
- co-operative acquisitions, such as the NATO AEW&C capability, whereby nations share the acquisition and support costs.

Many of these types of arrangements have already been used successfully by the DND/CF. However, they have been used as a means to supplement organic CF capability rather than as a way to replace functionality. Before using these measures as a means to effect structural changes to the CF, a number of issues will have to be considered. For example, reliability and timeliness of supply (i.e. when shortages occur, the supplying nation will typically look after their own troops first), independence of foreign policy, and impact on the Canadian Industrial Base should all be examined as part of a risk assessment.

Weapon System/Equipment Standardization. Increased collaboration with our Allies may have the benefit of increasing weapon system/equipment platform standardization on the battlefield. The benefits to be gained from multiple nations collaborating to field and support a particular weapon system have not yet been explored to the maximum extent possible. Only through

increased standardization and shared support capability may it be possible to enhance flexibility, and significantly trim the size of the support footprint.

Use of Reserves. Reserves offer flexibility to the military and could be especially attractive to support organizations. For support functions, which require a great deal of technical expertise, training costs can be reduced and the available pool of personnel to fill positions expanded through the employment of reservists who are civilian specialists in their areas of employment. There are, however, a number of issues regarding the use of Reserves in support roles. For example, the best structure needs to be determined (e.g. peacetime units include acceptable percentage of Reserve billets; units staffed by Regular Force cadres, and only employed as a unit when/if deployed; reservists train and deploy as formed units). How to attract and retain the right skill sets is a recurring theme (i.e. compensation issues). How to guarantee their willingness to deploy and train needs to be addressed (i.e. cannot jeopardize their civilian employment). Although these questions are applicable across the CF, they are especially pertinent for the support trades and occupations given they have civilian equivalents and should only require minimal exposure and training to become functional in a military environment.

Use of Defence Industrial Base. The integration of the Canadian Defence Industrial Base more closely into the Defence Team can be approached in a number of ways including contractor support on the battlefield, contractor backfill behind deployed CF personnel, and global contractor support networks coupled with expanded first/second line capability. Such use of the Industrial Base could act as a force multiplier, freeing up scarce resources and broadening access to specialized skill sets. However, there are a number of associated issues, particularly with battlefield contractor support. For example, how can DND/CF guarantee that the contractor will still show up when the shooting starts? How would contractors be able to obtain liability insurance for their personnel working in war zones? How would the Geneva Convention be applied to contractors aiding a military? Even in the case of contractor support provided off the battlefield, there are issues that must be explored. How vulnerable will the CF be if it eliminates organic capability from its structure? If CF capability is to be backfilled by industry upon deployment, how do we transition from one support mechanism to another? Many of these issues can be effectively addressed, yet they must first be considered.

Adoption of Commercial Practices. Over the past few years, acquisition and supply chain management in industry has undergone significant change in response to pressures from the market place. Goods and services must be provided faster, to more dispersed locations and often by external providers rather than by in-house resources. In response, a number of best practices have emerged which should be considered by the DND/CF.

- Strategic sourcing, sometimes referred to as the Prime Vendor concept, "bundles" various goods and services under one contract to a single/prime vendor. There are a number of advantages to such a procurement strategy, including a reduction in the time and effort afforded to the contracting process, as well as the vesting of overall responsibility, and accountability, for performance in a single contractor.

- By specifying only performance standards for the end product/service required as opposed to technical specifications covering conduct of the work required to

generate the required product/service, procurement lead times will be shortened by reducing the complexity of the contract paperwork required. Further, by including incentives to vendors for early or exceptional delivery/quality, users should expect the provision of faster, and higher quality, goods and services.

- Benefits Driven Procurement is the government approach to establishing partnerships with the private sector within the constraints of government contracting. It establishes a contract in which the contractor is responsible for delivering a solution that meets the project objectives, not meeting a detailed technical specification. Risk as well as benefits are shared between the contractor and Crown and much of the work needed to plan and implement a project is transferred to the contractor, while clear lines of accountability are maintained. Departmental staff are relieved of the difficult task of performing in-depth requirements analysis, and the company is free to use current, rapidly evolving technology.

- Rapid technology insertion akin to the IT sector's "multi-year time boxes" delivers innovative technology faster, in an incremental manner, influencing equipment acquisition programs through the identification of emerging technologies, development of new technology and rapid introduction of capability into the operational environment. To accomplish this, emphasis must be placed on the selection of platforms with "open" architectures, and therefore growth potential.

Just-in-time delivery changes the way inventories are managed. Current information technology and greatly enhanced commercial delivery systems permits a move away from a "just-in-case" concept of logistics support. The reduction in inventory, closure of supply depots, and holding of remaining stock in one location results in significant resource savings. There is risk associated with this approach in that the required item may not be delivered when required. To mitigate this risk, vendors are committed under contract to provide certain items of stock in the required amount, to the right place, at the right time, with the potential result that inventory handling costs are reduced, and fresh, in-date stock is received.

Leasing has become quite prevalent in the commercial sector. It provides cash management flexibility, tax advantages and attractive balance sheets. With the exception of a smoother cashflow, these financial advantages are not applicable in government procurement. However, the most attractive feature of leasing to the DND/CF is the increased flexibility to upgrade/change ageing equipment. Although, given the nature of some of the equipment purchased for the CF (e.g. armoured vehicles, fighter aircraft, warships, etc) it may be difficult to find a lessor for some fleets. This being said, there is still a significant portion of the DND/CF inventory which has significant usage in the commercial sector (office automation, helicopters, commercial pattern vehicles, satellites, etc) and leasing arrangements could be applicable.

Future MA&S

MA&S planners must be "plugged into" the operational planning process. In addition to gaining and maintaining a sound grasp of the operational imperatives, MA&S planners would also insert the support view into the discussion so that opportunity costs and implications of operational capability choices are surfaced before decisions are taken. With the strategic framework (political and operational) articulated, MA&S planners must then develop a consistent support concept. The resulting MA&S doctrine and structures will have to be flexible and take into account the many opportunities for increased effectiveness and efficiency offered by the potential strategies explored in the preceding sections. While doctrine and structures will change, the mission of supporting the fighting capability by delivering to operational commanders the right materiel in the right place at the right time, will not. The RMA may add a new dimension and complexity to this process, and presents numerous challenges which must be met "head on".

Recommendations

1. DND/CF must establish and validate sound operational concepts, upon which MA&S planners can base a valid support concept.

2. Required legislated changes must be considered which would protect the civilian jobs of Reservists, thereby enabling a different support paradigm.

3. DND/CF must put increased emphasis on standardizing equipment, components, and consumables with its Allies, and must increasingly utilize "open" architecture platforms to permit interoperability and growth potential.

4. Steps must be taken to increase confidence and safeguards in contracting with Industry, particularly with respect to its ability to deliver to in-theatre locations, and its ability to accomodate "home nation" priority.

5. DND/CF must aim to trim the size of the support tail/footprint throughout the supply chain, particularly in-theatre. Consideration should be given to paralleling civilian practices in peacetime but have the expansion capacity to provide for a more robust and reliable system in wartime to reduce the risk to deployed forces.

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Chapter 5: Industry/Defence Interdependencies

Introduction

This chapter discusses the changes that will likely impact the direction of Canadian defence and its interrelationship with industry. It is envisaged that greater interdependency between Defence and Industry for 2010 will be required because of the cross linkages between the RMA and the Revolution in Business Affairs (RBA). The agile corporations of today are seen as precursors to the organizational business models comprising companies and other international business collaborations, partnerships and joint ventures. With new niche technologies, further specialization and diversification of defence industries, new international collaborative arrangements being formed, and increasing international competitiveness, the future business environment will be very different from that of today.

Enabled by the Internet, competition will increase in an "RMA" oriented world. The policies being articulated by Dr. Jacques Gansler, Defense Undersecretary for Acquisition and Technology, regarding global sourcing, which are aimed at opening up more of the US defence market to foreign firms, should accelerate the trend toward globalization and an increasingly competitive defence products and services market.

The RMA phenomenon enhances the need for the US, its traditional allies and other potential coalition partners to focus on interoperability issues in weapons system design, production, support and training. A critical need is a common operating system using a common communications system to enable allies to 'plug and play' with the US and other coalition allies. This may be a great opportunity for Canada to become a world-leader in niche communication technologies critical to interoperability. Identification of current niche technologies in which Canadian Industry currently excels, which could be 'cherry-picked' by the CF as Commercial-Off-The-Shelf (COTS) may be solutions to future requirements. Continuous monitoring of the commercial marketplace may also serve to identify new niche technologies that need to be developed to fulfil the requirements of the CF of 2010 and beyond to ensure our preferred trading position and interoperability with our largest customer and ally.

DND's Industry Processes for 2010 and Beyond

Canadian Industrial Base: New mechanisms must be employed to ensure a viable and vibrant Canadian defence industrial base for 2010 and beyond. Mechanisms for controlling resources within DND; investment by Industry in the R&D required as part of the procurement process; risk and the requirement for tangible returns; and the establishment/maintenance of a healthy industry/government collaborative arrangement focussed on 2010 and beyond are some considerations.

The defence industry will need to integrate its future programs much more closely with the strategic direction of the department. To do so will require early identification of DND/CF requirements and close partnering with key Industry players to satisfy these requirements. Canadian defence industry must co-operate even more closely with the Canadian industry

associations and academic communities (as well as OGDs) on development programs for the future single battlespace.

International Competitiveness

New collaborative mechanisms should be adopted by both government and industry to allow industry to compete more effectively in the global defence marketplace. Current government initiatives as well as new industry initiatives to help industry compete effectively internationally may be advanced. Concepts such as the US (Gansler's) "Total Cost of Ownership" with respect to DND's concept of life cycle management to include conceptualisation and development stages should be considered.

Procurement Process: The role that ADM(Mat), CRAD, and the environmental equipment managers play in the procurement process includes the requirement for a paradigm shift which will require links with industry to develop a knowledge-based framework for effective and efficient acquisition decision-making. It should be stressed that new forms of procurement processes will be dictated by market forces that ensure the survival of organizations that can adapt to the future. Perhaps the UK trend outlined in its Strategic Defence Review (SDR) towards private finance initiatives (PFIs), the initiative of smart procurement which echoes 'acquisition reform' in the US, could be considered. Both approaches sought faster, cheaper, and better ways of acquiring equipment for their respective armed forces.

DND/Industry Response to the Revolution in Military Affairs

The first of three key components of DND's response to the RMA phenomenon affecting industry directly involves policies/mechanisms for the integration of new technology with new DND strategic, doctrinal and organizational concepts for 2010 and beyond. The second are those current and future niche capabilities for application to defence requirements for the 2010 timeframe. The third is the determination of the role of industry in sustainment, support and maintenance activities with respect to asymmetric warfare in the 2010 and beyond timeframe.

Policy for Niche Capabilities: A considerable number of policy changes will need to take place to achieve the ability to integrate new concepts in organization, doctrine and technology. A corporate approach which emphasises co-operative business approaches and alliances and removal of duplication in the current IT framework (e.g. the removal of stovepipe information systems) is required. A mechanism for retaining and enhancing CF and Departmental corporate memory is required. Smart procurement was announced by the British in its most recent Strategic Defence Review (SDR), wherein the MoD would plan to purchase capabilities rather than equipment and improve purchasing methods by bringing in industry representatives at an earlier pre-definition stage; theoretically taking new technology to the front line faster.

Although the Defence Industrial Research Program (DIRP) has contributed to the development of Canada's niche defence technologies and helped produce capabilities that satisfy the CF's and the Department's military requirements, a new approach is needed. Demand for financial assistance by new agile defence corporations is not being met under the current DIRP. Perhaps the joint development of the DIRP by developing the program through joint funding with a research development aspect would be more effective and engender better business

relationships between the Department and Industry. Perhaps an alliance of a network of Defence Partners in Industry and government could be created which could play a key role in the integration of defence and government capabilities along with the integration of new doctrinal and organizational concepts. Currently, the Canadian Defence Industries Association (CDIA) brings together defence and industry interests, and the Commitee of Defence Association (CDA) is the organization which lobbies defence interests to government. Perhaps a sub-committee, reporting to the network twice a year, could be responsible for focussing industry's contribution to concept development, integration and experimentation.

Current policies and mechanisms may need to be amended to allow programs to be better geared toward seed investment for research and development. An important strategic element is the need for a continuity of vision within the Department, with an emphasis on developing and retaining corporate memory and acquiring and retaining people skills, especially in the area of IT.

Current procurement processes create a barrier between the defence client and the defence company supplier and this needs to be changed. DND could handle major defence procurements itself. To ensure that any procurement process is efficient and effective is to understand the culture and landscape of the procurement relationship between clients and suppliers and to recognise that in agile corporations, there is a merging of these roles and interests.

Requirements must be described in terms of capabilities rather than as inflexible, "military spec" items. Strategic and flexible teaming between and among business and government entities should be encouraged. In addition, the existing system for processing new equipment takes too long, especially in high technology areas, and new remedies need to be found. The leasing versus purchasing option is suggested. Furthermore, new policies need to encourage the broader scope of systems and functions that could be included in "outsourcing" of goods and services. Alternate Service Delivery (ASD) should be touted as a solution. The people side of the equation should be emphasised, if the Department is to lend credence to being a "service" organization. Creation of partnerships with Industry for all stages of procurement should be considered. Along these lines, teaming arrangements should start at the concept stage, proceed through the various stages, where applicable, to the competition stage, to the investment stage. The Public Works and Government Services Canada or an equivalent DND organization is an important body because of its expertise in the rules and regulations that surround procurements. Whatever form a new procurement organization may take, what is important is that its continuity be maintained and it must be streamlined.

Future Mechanisms: If partnering between government and business is to be successful, there must be a balance between risk sharing and funding. In twenty-first century partnering arrangements, the government must accept its portion of the overall risk of a project, work assignment, program or joint venture. By forming integrated project teams (IPT), some of these risks can be minimised. For example, labour shortages, skill deficiencies, predatory pricing and encroachment on a company's market share can be minimised by taking these and other factors into account when negotiating partnership arrangements with other companies or with non-profit entities. Government funding should only be provided when there is no other compatible project

that would add to discounted future net cash inflows. A project demonstrating potential for maximising these returns is the obvious candidate for funding by another company (a venture capitalist) or by a government department or program.

New Niche Technologies: New niche technologies that support the RMA-type concepts should be identified as soon possible and the role of Canadian defence industries clearly defined. World-class Canadian niches could be developed in: visualisation versus data displays, digitisation for mapping, remote service delivery, nanotechnology, software development, communications, virtual reality (VR) robotics, VR, geomatics, safeguarding of essential elements relied on by defence, evolution of mine detection, 3D imaging, and optics.

Advanced Technology Demonstrators (ATDs) should be used by the Department to a much greater degree. Industry is in a position to make a very important contribution to the technology demonstration process and would then be in a good position to help take the product/capability to a commercially produced item if DND decides to proceed.

Intellectual Property Issues in an RMA world: The role of intellectual property (IP) in an RMA world is not simple. Traditionally, the party that funds the R&D was the party that owned the asset. In the new business world of the 21st century, IP has little value unless it can be shared with the business party who can market it. This philosophy contravenes conventional thinking, which tends to relegate IP solely as an asset on the books, unless it can be demonstrated that follow-on sales will be generated. One of the main problems in dealing with IP currently is the artificial separation of the procurement function from the IP investment. Furthermore partnerships with business must respect the national security and foreign policy interests of Canada.

Safeguarding of Commercial Assets relied upon by Defence: The notion of safeguarding those commercial assets that the DoD is relying on is also a relatively new RMA type issue. It may have particular relevance to Canada, particularly because of our strategic and defence relationships with the US via NORAD. DND needs to seek a diversity of ways of maintaining this particular capability, mainly through the leveraging of Canadian expertise. One of the better solutions would be the selection of an administrative vehicle that provided an integrated solution from concept to implementation. Once chosen, the process should be followed consistently from the R&D stage within the Department to the Requisition for Proposal, to the bid selection process, to the award and execution stages. The extent and manner in which the commercial asset would be used should also dictate the approach which will best provide the desired safeguards. When it comes to IT, and reliance on space assets, not only is the physical asset at risk, but the consequent information that is derived, used and or manipulated is also critical to functionality and must be safeguarded.

Summary of Recommendations for DND/CF Interdependence with Industry

1. DND and the defence industry should investigate ways to enhance and expand their co-operative relationships in order to leverage resources (including increased investment) to the benefit of both partners in a RMA world. Once a detailed framework has been developed for the DND/CF of 2010 and beyond, an affordability study should be carried out complete with trade offs. This study can be used to make the case for increased funding to DND when Cabinet sets its priorities.

2. Symposia on RBA, similar to the one carried out by the Department in June 1998, should be continued to take advantage of the evolving trends.

3. Future defence requirements should be framed in terms of capability, rather than specific attributes. Future required defence capabilities should be established.

4. The capabilities of the Defence Industry Community, involved at an early stage in the procurement process, should be fully utilised by DND in the establishment of the future force. Early involvement would assist Canadian industry to be much more competitive internationally.

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Chapter 6: Human Resources

The RMA & Human Resources Management

While many see the RMA as mostly driven by technology and focused on warfighting, it cannot be fully exploited without a serious examination of the human element. New technology, new doctrine and a changing battlefield call for a serious re-examination of the principles that underpin Human Resources Management. Today and in the future it will be the people that will make the changes in doctrine, organization and technology that constitute any RMA. In sum, Human Resources issues are at the centre of all the changes that will occur as is illustrated in Annex A.

In their book *War and Anti-war*, the Tofflers raise some interesting ideas that we can apply to the "people" issue. They write that we approach war as we approach the creation or increase of wealth, and that we prepare for anti-war activities the same way that we do for wars. These ideas help confirm that there is a direct relationship between RBA and RMA. The private sector is trying to find answers on the proper use of the labour force in the Information Age. The military community will deal with very similar questions and in answering them they can use the private sector answers or find their own. Presently, there are more questions than answers, but there is the conviction that it will no longer be business as usual.

The impact of technology on any society is measured, in part, by the new human behaviours induced by that technology. These new behaviours, even if they are not clearly known or understood, influence the way that we improve workplace performance. Human Resources Management is more than developing the appropriate recruitment processes, or the mechanisms to train and develop an individual. It is about making sure that we have a sustainable workforce able to use and improve the technology available within an appropriate vision and structure. These new requirements will demand innovative thinking and adaptable Human Resources (HR) professionals as well.

The foregoing will influence and shape the individuals who will constitute our future defence forces. These changes will influence how leaders will secure commitment from future members and also how DND/CF will strive to enhance servicepeople's performance. Today, we do not know exactly how and when these Information Age changes will stabilize, and this means we will have to contend with an unstable environment and be prepared to make frequent adjustments to our HR practices. Human Resources Management professionals will have to be dynamic, flexible and adaptable. They will have to develop and employ methods and approaches that will reflect these qualities.

Human Resources trends such as demographic changes, workplace practices, diversity, level of education, integration of women, and immigration patterns will require a complete review of the present HR system. Until recently we have modified HR practices in a piecemeal fashion. We have approached technical changes in the same way. It is increasingly obvious that we must examine transformations in all HR areas through a global and holistic approach. Civilian organizations have struggled with new human resources management practices for a

longer time than has the military. Therefore, DND/CF will benefit through studying their procedural successes.

Present and Future Human Resources Considerations

Adapting technological changes to human terms—mission, purpose, capacities, knowledge level, adaptability, organizational and political structures, etc—is the logical way to proceed. A strategic Human Resources management framework for the Information Age must address DND/CF's capacity to attract, retain, develop, and lead men and women who will be fully able to respond to all of DND/CF's commitments.

Attracting: Canada's demographic landscape has changed dramatically in the last fifty years. The population is comprised of an increasing "greying" segment. Canadian's overall level of education is at its highest ever. The present generation of Canadians seems to be less committed to their employer. These realities mean that DND/CF needs to devise personnel policies that enable it to attract and retain a new range of potential candidates. DND/CF also needs to further open its ranks to reflect Canada's growing cultural and linguistic diversity. The Department and the Forces will have to continue to ensure equitable opportunities for all Canadians.

DND/CF is only one of many potential employers in today's highly competitive labour market, whose appetite for so-called knowledge workers seems insatiable. Today's potential candidates for DND/CF recruitment are more self-sufficient. For long-term security they rely more on their self-acquired expertise than on the prospect of retention with a single employer. To sustain their expertise, they must be engaged in continuous learning effected through movement between the workforce and the educational arena. Since these knowledge workers believe their opportunities are limited by the overwhelming number of baby-boomers, they are highly competitive and are not driven by loyalty to one employer.

New Human Resources policies must enable DND/CF to be an employer of choice. To ensure this DND/CF must develop appropriate recruitment and retention requirements and standards, recruiting incentives, career paths, challenging opportunities, and quality of life initiatives.

Retaining: Canadian societal values have evolved. The global marketplace, through its exchange of goods and ideas, has exercised influence on existing cultural, ethical and moral issues within Canada. The present political environment reflects our society's difficulty to define its allegiances (global, national, and regional). This difficulty stems in part from the fact that recent economic changes have fostered a new individualism where the citizens are learning to live without the help of the State.

Canadian citizens are not yet convinced that DND/CF has demonstrated a capacity to treat its members properly. We will have to prove, through defining a military ethos grounded in the values and characteristics commensurate with society at large, that being a member of the Canadian Forces is a valid and honourable career option.

The above is achievable by raising career satisfaction, improving command climates, keeping pay competitive and benefits stable, reviewing regulations for postings to reduce

hardships on families, considering new options for the integration of reservists, implementing quality of life initiatives, and examining the impact of deployment on CF couples.

Developing: The May 1996 Auditor General's Report to the House of Commons examined CF training and development functions. It pointed out that the present system is unable to ensure that CF members are properly trained for the spectrum of missions they may be called on to execute. Technological innovations are placing increased stress on the availability of a relevant curriculum and the time available for necessary training and skill development.

The training system will have to face the fact that increased knowledge is empowering people. DND/CF must review its training practices and development policies to allow members to meet the challenges of tomorrow. The future training/development function must be open and flexible. It should not be limited to formal training.

Less traditional training options must be considered, such as experience in the private sector, partnerships with other federal governments, exchanges with allied forces, acquiring training and developmental means outside of DND/CF, and liasing with outside specialists and experts. The primary objective is sustainability: DND/CF members should benefit from an agile system that is able to change rapidly and adapt to state-of-the-art-knowledge. All training must be relevant to the job at hand.

Leading: The evolution of the global economy and the Information Age is effecting its greatest impact on society's leaders. New technology fosters an organizational environment where undue constraints on communication defeat its benefits. These changes necessitate a new type of leader, able to work with knowledge workers to maximize productivity and results. Those leaders must be able to grasp and encourage innovations at all levels of their organization.

The main attributes of new technology are its ability to remove traditional constraints of time (diminution of delays due to accessing and processing the information), of distance (everybody and everything is accessible via networked computers, e-mail, net meetings, etc.), and of matter (the new important matter is service, knowledge, information). New technology is also providing the means to create customized products and services at an affordable price.

Future organizations will have to provide their customers better products and services. They will also have to competently lead employees as today's workers expect nothing less. To stay relevant, employers will have to learn and to master open channels of communication, minimal chains of command, and have confidence in empowered members. Roles and responsibilities will be determined by one's competency to accomplish specified tasks, not by the power derived by a hierarchical structure. The various components of organizations will fluctuate constantly. Leaders will help enhance the power of their people and the effectiveness of technology through delegating responsibility and providing solid leadership.

An organization's leadership will provide vision, develop strategic direction, monitor results, and take the steps necessary to progress initiatives. They will have functional expertise, core values, and high ethical standards. They will have to understand the intricacies of governance, international issues, and the role of different actors (international, government, and non-government). They will also need to transfer that understanding to their subordinates to improve the entire organization's capability to meet diverse challenges.

New Work Arrangements

DND/CF employs more than 100,000 people (Regular-60,000, Reserves-30,000, Civilian-20,000). Career-long employment with a single employer is no longer the norm. As an employer, we must consider work arrangements that are a better fit for Canada's evolving social and demographic structure as well as for the implications of a global economy. Within these new work arrangements the key to achieve a proper balance between budgetary constraints, operational requirements and people needs is flexibility. Below are some examples:

Flexible careers: The new definition of careers is not based on fidelity to one employer. The knowledge worker needs to be exposed to a multitude of opportunities to maintain his/her expertise.

Part-time, leave for education, assignments in other departments, sabbaticals, private sector experience, are some ways to achieve wider exposure to civilian life issues. This exposure will widen the spectrum of answers to potential conflicts stemming in societal changes, such as: poverty, lack of opportunities due to lack of education, unemployment, social unrest, and political instability.

Flexible deployment patterns: Deployment to different locations and professional environments is the traditional way to develop a military career. Today's cultural and societal imperatives demand that we revise this approach as it is a deterrent to recruitment and retention. It has negative ramifications for single parent families, for families in which both parents have careers, for families who struggle with competing obligations (sick children, care of old parents, children at university, etc.), and for CF couples.

CF members should be able to voice their opinion regarding deployments without jeopardising their career. They should also be able to limit their career progression without ostracism. Moving costs are important and additional measures could be taken to limit them.

Flexible development and learning: Unusual operational requirements demand that DND/CF focus their training and development systems on competencies and skills that cannot be acquired in the private sector. Developing a competency profile for different classifications and levels of responsibility will provide the member with sufficient information to take charge of his/her own development and seek the appropriate resources. The organization will have to monitor the results and their congruence to requirements.

External training sources would be less expensive as each member would get only what is needed. The current prescribed curriculum forces all to go through the same process, regardless of need. A more flexible approach to development and training will target the individual and

organizational needs. It will also be able to provide a just-in-time learning. Savings in time and money can be anticipated.

Flexible regular and reserve service: The Reserves represents an important pool of persons who provide the CF much additional needed skills and abilities. Allowing them to easily transfer to the Regular Force and back again should tend to increase the pool of Reservists and better provide the ability to increase the size of the Regular Forces as needed.

Regular Forces are the most expensive components of the DND/CF workforce. The concept of just-in-time employment will reduce total cost by increasing the number of persons who are ready to be mobilized when required. It will allow for a better selection of key competencies, which are adequate for different type of missions.

Reserves offer other options that are worthy of consideration when we talk about the flexible career model. They have valuable skills that they use in civilian life. DND/CF should be able to capture reliable data on the non-military skills available amongst the Reserves. This data would increase the potential for their use in various capacities. It will also add the possibility to use these skills and knowledge and transfer them to the Regular Forces when the nature of work calls for it.

Flexible Civilian and Military Integration: Civilian employees are an important part of the Department. They provide the necessary stability and continuity to carry projects and initiatives through to effect the transformation of DND/CF. These employees also provide the Armed Forces with needed support for military operations.

The new workplace requires a flexible environment where there are fewer artificial barriers. The aim is to accomplish our mandate. To do so, it is crucial to rely on a variety of expertise. Visions like Defence Team are becoming more important than ever. The question is not who is driving what mission, but what the mission requires in terms of leadership or expertise to be successfully accomplished. Increased collaboration could ensure that the right person for the right mission was assigned. In humanitarian missions civilians may be better suited for the job. In other instances, it is a multidisciplinary team that would be the right answer.

Summary of HR Recommendations

Just as we have to modernize our equipment, we also have to modernize our Human Resources practices. This requires appropriate Human Resources policies enabling DND/CF to attract, retain, develop and lead its members.

1. DND/CF requires a modern and forward-looking Human Resources system, that caters to the unique requirements of both its military and civilian personnel. It is becoming more important than ever that Human Resources functions and activities be handled by Human Resources professionals who have a strategic outlook.

2. DND/CF must examine flexible methods to attract future members. Flexible employment contracts and flexible career paths will enable DND/CF to recruit from different groups.

3. The training and professional development system needs to be more adaptable to fit the constant changes in required skills and competencies. The technical content of RMA as well as the changing nature of international security will require the training system to provide academic and technical training so that military and civilian personnel are able to meet future force requirements.

4. One avenue to explore to aid retention is the flexibility of movement between the Reserves and the Regular Force. It would be valuable to increase the movement back and forth between Regular and Reserve Forces by recognizing the value-added by any civilians ready to offer their services and their expertise to the military.

5. Another retention issue concerns the requirement for the CF to reflect Canadian societal values although the conservative nature of the organization means that it may lag by a generation. Nonetheless, DND/CF will need to support and reward its members for their service. Equality is not synonymous of equity or justice. More flexible approaches will be able to respond to individual needs, some of those approaches are: family-oriented programs, compensation benefits, development of strong values, diversified opportunities, and flexible career patterns

6. DND/CF must develop leadership models best suited for an Information Age environment where communications and decision making occur at a more rapid pace than ever before. The leadership model must include the ability to work as teams and to support empowerment and responsibility for results at all levels.

Chapter 7: Conclusion

Much has been done since May 1998 in initiating a DND/CF approach to the Revolution in Military Affairs. The Canadian Defence Beyond 2010 Symposium held on 30 November, 1 December 1998, exposed many within DND/CF to expert presentations and allowed the Symposium participants to take part in focussed workshops that further explored the RMA. Although understanding of the RMA is improving rapidly within the Department and the Forces, the process of exploring future defence trends is only at the beginning. The changes in the international arena stemming both from the end of the Cold War and rapid advances in technology are altering the way warfare is conducted. This fact necessitates that future defence trends tied to these realities be closely examined and their impact on DND/CF considered, as they may offer us ways by which to improve our capabilities. It is hoped that this Concept Paper will further this process.

DND/CF needs to develop a coherent, long-range vision of the impact the RMA will have, not only on the CF, but also on war-fighting in general. The objective must be to understand the RMA in its conceptual entirety while ensuring that the overarching vision that is developed is directly focussed on Canada's strategic needs and selectively serves Canada's interests. DND/CF must explore and strike a balance between the potential gains and risks of moving towards an RMA. We cannot, however, allow this analysis of risks to paralyze us, for if we do not move towards the future in a pro-active way, DND/CF may lose its relevance in terms of its combat capability and, by extension, its ability to support Canada's interests abroad. This Paper and its recommendations are aimed at this objective while areas for follow-on analysis and program development have been identified.

A DND/CF contribution must be credible and relevant. The criteria that DND/CF will have to meet includes interoperability with allies and a capability to work along with Other Government Departments (OGDs) and Non-Governmental Organisations (NGOs). We must be adaptable and agile in the thinking and execution of our responsibilities. To achieve a robust, relevant and combat capable force DND/CF must further study the RMA. To effect this a dedicated group of military and civilian members needs to be formed to develop a plan through which we can exploit the opportunities of the RMA as well as other future defence trends while avoiding their shortcomings. This group would explore these trends holistically, without any intellectual limitations. The group would consider no area of DND/CF structure sacred. It would look for new and innovative ways to achieve Canada's defence needs and would seek to provide direction over considerations of consensus building. Reporting to the VCDS would foster innovative thinking and help to preserve the originality and vigour of the group's ideas.

DND/CF should engage in experimentation with concepts in future technology, organization and doctrine. Presently there are a number of attractive opportunities available to engage in experimentation, particularly with the United States. We should explore these options and seek participation where appropriate. In doing this we must always ensure that our co-operation with the US and our other allies is beneficial to Canada's goals and interests. DND/CF should also stand-up an experimentation center of its own, where doctrine, technology and organizations can be tested to determine their practicality and effectiveness before they are incorporated into our force structure. Experimentation will allow us to acquire the right systems

and equipment, and to properly integrate them into our force structure and doctrine. The recommendations of this Paper can be accomplished through seeking national co-operation and co-ordination. Furthermore, OGDs must be made aware of our capabilities as the understanding of the capabilities of DND/CF will enable the OGDs to make better choices in requesting our assistance.

The way ahead includes the implementation of the Paper's recommendations through either the DMC or AFC. Prior to this, a number of steps must be taken in sequence. The first step is the approval of the recommendations of this Concept Paper. Second, the recommended dedicated group should be established to study the implications of the RMA and other future defence trends. The third step would include experimentation to determine if the group's recommendations are relevant and achievable. Lastly, following experimentation, a priority list will be drawn up to properly sequence the implementation of changes. Throughout the experimentation and follow-on stages of this process the concerned Environmental Chiefs of Staff and the Group Principals should be included. Indeed, at the operational and tactical levels these players should have maximum input.

The many contributors to this Concept Paper on *Canadian Defence Beyond 2010* hope that it significantly furthers the understanding of the RMA's relevance to DND/CF and encourages the growing effort to develop and implement an overarching plan for an effective, survivable DND/CF in 2010 and beyond. Moreover, the authors of this document hope that it provides a dynamic framework with which to move the Department and the Forces towards the future.

ANNEX A - DND/CF's Approach to 2010 & Beyond - Recommendations

The individual chapters contain specific recommendations which are often repeated elsewhere, yet from a specific point of view on that topic. Wherever possible these individual recommendations have been combined below and presented from a DND/CF point of view. The recommendations below are not presented in any order of importance:

1. In order to focus on future strategic thinking, a working group should be formed to precipitate the integration of the future programs (including concept integration) of the Department so that a coherent well-defined DND approach to 2010 and beyond is established. Reporting to the VCDS, this group, with clear terms of reference and a definite lifetime, would contain subject-matter experts from key parts of the Department and would be led by a Flag/General officer. Co-ordination with our allies and the utilisation of expertise in academia, industry and OGDs will be a critical component of this group's job.

2. A systematic DND/CF wide approach must be taken to interoperability in 2010 and beyond both within DND and with our allies in combined operations. International agreements with Canada's allies must be used to pro-actively promote optimum future interoperability and the establishment of standards.

3. The area of asymmetric threats requires a focussed, detailed and co-ordinated approach to prepare for future warfare:

- A national infrastructure vulnerability centre should be established to co-ordinate Canada's response to asymmetric threats. Interested organizations would include DND/CF, industry, institutions (such as banks), police organizations and other government departments.

- Work on asymmetric threats should be closely co-ordinated within DND. This will allow Canada to develop strong niche areas of expertise and help to leverage the resources devoted to this area with our allies.

- A pro-active approach to asymmetric threat co-ordination with our allies should be taken, including the establishment of a sub-committee under the bilateral CA/US Military Cooperation Committee and a joint S&T/Intelligence panel reporting to the TTCP (The Technical Cooperation Program) NAMRAD (Non-Atomic Military R&D) (CA, US, UK, AS, NZ) principals.

4. Experimentation with concepts is essential to prepare for the single, integrated battlespace of the future.

- The establishment of a Joint Experimentation facility is essential to the exploration of S&T, doctrine and organization concepts for 2010 and beyond.

- Much greater use should be made of advanced technology demonstrators which involves the use of operational research, the force development client and the requirements client

much earlier in the process and is much more suitable for concept development in the 2010 and beyond timeframe.

- The establishment of a focussed capability (adapted for Canada) in SMART (Simulation and Modelling for Acquisition, (Mission) Rehearsal, and Training) is essential for a coherent approach to 2010 and beyond.

- The new Network of Defence Partners in Science and Technology should play a key role in the integration of S&T with new doctrinal and organizational concepts for 2010 and beyond.

Close contact and collaboration should be established with the new US J-9 organization (particularly with the new J-9 Joint Battlelab) which is responsible for Joint Experimentation. A detailed analysis (including applicability to Canada) of how the US is developing concepts, carrying out experimentation, and assessing and implementing the results should be undertaken. An examination of the merits of a DND/CF J-9-like organization (focussed on the specific missions of the CF) should be undertaken.

5. It is proposed that a CA/US Cooperative Program for Technology, Research and Development be established to increase and focus technology co-operation with the US to facilitate DND/CF preparations for 2010 and beyond. This program would allow us to leverage our limited resources with the US who is expected to lead major coalitions well into the future.

The future S&T program that is currently being developed should be closely integrated with the rest of the Department's future programs, especially with those responsible for developing new concepts in doctrine and organization. All those with a stake in this new DND S&T program should participate in the consultation process that will start in a number of months.

6. The exploitation and integration of spaced-based capabilities must be studied and considered for implementation in the CF. The migration of many traditional capabilities, such as communications and surveillance to space and the continuing enhancement and development of other capabilities demand that spaced based assets be fully integrated into CF operations and planning. The potential for space capabilites to provide joint support must be maximized.

7. The Materiel Acquisition and Support (MA&S) community must aim to minimize the size of the support tail/footprint throughout the supply chain, including in-theatre. The most advanced information management techniques must be employed to provide timely, focussed support in the dynamic future theatres of operations. Increased emphasis should be placed on standardising equipment, components and consumables with our allies. Steps must be taken to increase confidence and safeguards in contracting with industry, particularly with respect to its ability to deliver to in-theatre locations, and its ability to overcome "home nation" priority. Future support concepts need to be developed which are closely integrated with, and based on, sound operational concepts.

8. The global marketplace is driving change in the industrial sector meaning that the companies of the future could look much different from their current day counterparts. This

profound change will be accelerated by the linkages between the RMA and the Revolution in Business Affairs (RBA). In turn, this will drive the requirement to improve ties between industry and DND/CF. To that end, existing relationships must be solidified and new ones forged. Our exploration of Material Acquisition and Support indicates that much can be done to improve the end-to-end procurement process. Doing so will benefit Industry as well as the Department. In addition, opportunities exist for industry to become more actively involved in a new support paradigm and the extent of involvement in this area needs to be actively explored.

9. Optimising the role of the human and providing support on the battlefield of the future is critical to the future DND/CF:

- Increased emphasis will need to be placed on assisting 2010 and beyond commanders with decision making, which, due to rapid information processing and dissemination, will often be made at lower levels.

- Increased effort will need to be devoted to the support of the human (psychological, physical and environmental) in the single battlespace of the future.

- The degree to which the platforms and systems of 2010 and beyond should be tailored to optimise the man-machine overall performance should be determined.

- The degree to which humans can or should be replaced in the platforms (autonomous unmanned vehicles) of the future should be determined.

- "Human" intelligence capabilities need to be addressed for the future battlefield and operations other than war.

10. It is recommended that a working group be created to examine all Human Resources consequences of RMA, including a complete review of the Leadership Model and organization structure. Other Human Resource recommendations with respect to the coming RMA environment include:

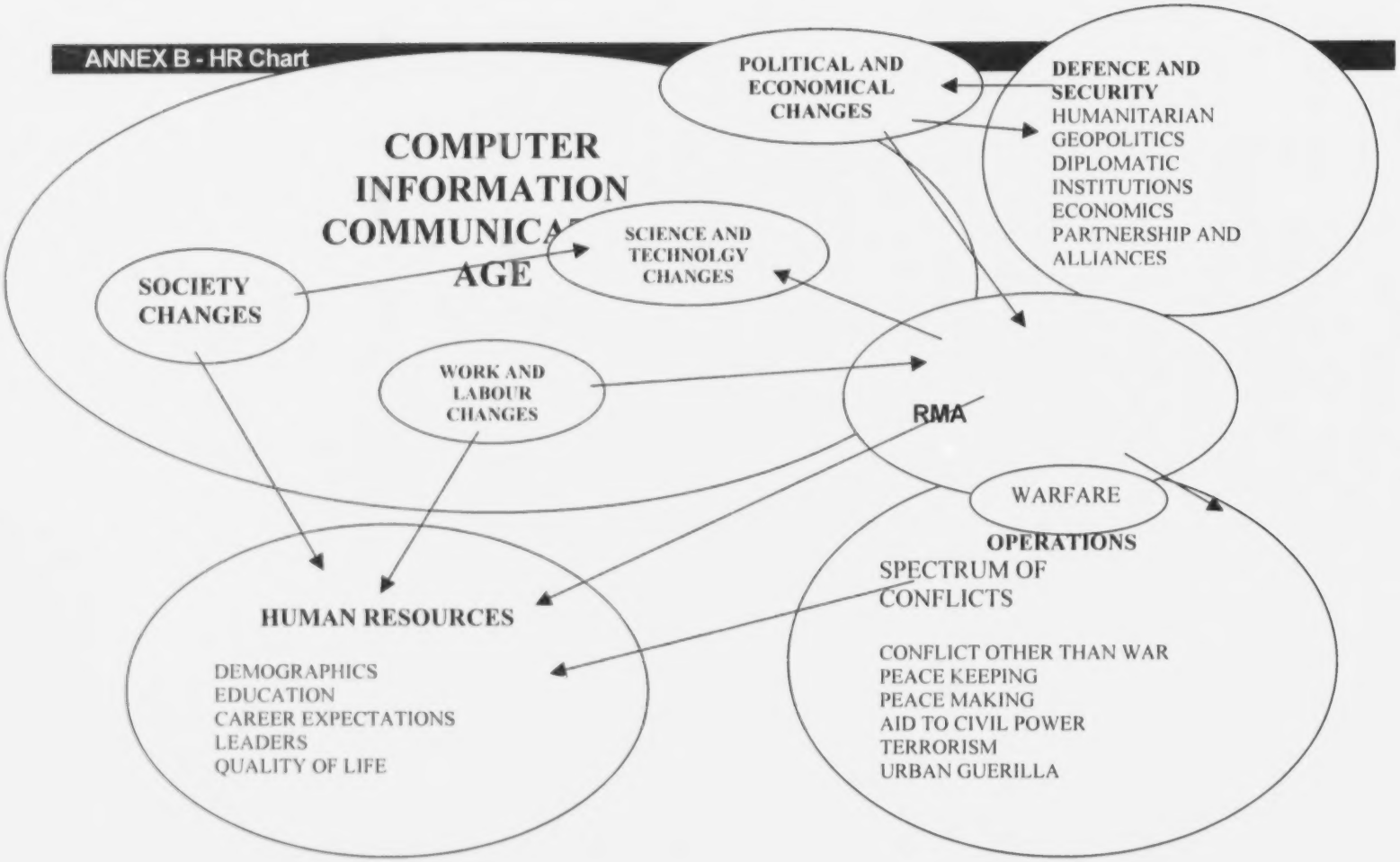
- A complete overhaul of the training and development package for the regular military and the reserves.

- A review of the role of the Reserves and of DND civilians and how their contributions to the overall DND/CF mission can be optimised in concert with that of the Regular Forces.

- Formulation of work environment and career challenges designed to retain identifiable groups such as women and visible minorities.

- The development of more flexible approaches to respond to individual needs in areas such as family-oriented programs, compensation benefits, development of strong values, diversified opportunities, and flexible career patterns.

11. The entire Canadian Defence Community must cooperate to the fullest extent to meet the challenges of the future. To this end, maximum advantage must be taken of Canadian expertise in industry, academia and OGDs. Additionally, we must leverage allied efforts wherever possible in order to operate and survive in the single integrated battlespace.


ANNEX B - HR Chart
POLITICAL AND ECONOMICAL CHANGES
DEFENCE AND SECURITY
HUMANITARIAN
GEOPOLITICS
DIPLOMATIC
INSTITUTIONS
ECONOMICS
PARTNERSHIP AND ALLIANCES
COMPUTER INFORMATION COMMUNICA AGE
SCIENCE AND TECHNOLGY CHANGES
SOCIETY CHANGES
WORK AND LABOUR CHANGES
RMA
WARFARE
OPERATIONS
SPECTRUM OF CONFLICTS
CONFLICT OTHER THAN WAR
PEACE KEEPING
PEACE MAKING
AID TO CIVIL POWER
TERRORISM
URBAN GUERILLA
HUMAN RESOURCES
DEMOGRAPHICS
EDUCATION
CAREER EXPECTATIONS
LEADERS
QUALITY OF LIFE

ANNEX C - US Armed Forces Future Service Visions

Below are the US Air Force, US Navy, US Army and US Marine Corps' future service visions. They are included as an annex to this Concept Paper as they offer insights into how the individual US service branches responded to both *JV2010* and the challenges posed by the FSE and RMA style changes.

Air Vision

Global Engagement: A Vision for the 21st Century Air Force provides the U.S. Air Force's Vision for the Future. Shaped by *Joint Vision 2010*, the vision was released in 1996 and calls for maintaining and improving six core competencies:

- Air and space superiority. This involves control over what moves through air and space. It prevents adversaries from interfering with the operations of air, space or surface forces, and assures freedom of action and movement.
- Global attack capability of the Air Force. This is in part to deter nuclear war as during the Cold War, but more importantly today is to deter conventional war.
- Rapid global mobility, enabling the Air Force to move forces rapidly to any spot on the globe.
- Precision engagement, which the Air Force defines as the ability to locate the target, provide responsive command and control, generate the desired effect, assess the level of success, and reengage if required (taken from *JV 2010*). The essence of precision engagement is to apply selective force against specific targets to achieve discrete and discriminant effects.
- Information superiority. The role of the Air Force in this area is for its air- and space-based assets to provide global awareness, intelligence, communications, weather and navigation support.
- Agile combat support. Effective combat support by the Air Force allows combat commanders of the other services to improve the responsiveness, deployability and sustainment of their forces.

Global Engagement notes that the Air Force has established six new battle labs to implement its vision. The experimentation labs are to identify and validate new ideas and innovative technologies that will improve the Air Force's ability to execute its core competencies. Areas of concentration are: unmanned aerial vehicles, information operations, air expeditionary forces, space capabilities, battle management command and control, and force protection.

Global Engagement foresees a much smaller Air Force, but one which is made up of more highly educated individuals with broader perspectives. Our people must understand the doctrine, culture and competencies of the Air Force as a whole in addition to mastering their own specialties. To create an environment that fosters responsiveness and innovation, the Air Force has initiated adjustments to its career development patterns for its officers, enlisted personnel and civilian force.

Navy Vision

The Navy's future vision of warfare, delineated in *From the Sea* (1992), *Forward . . . From the Sea* (1994), and further developed in the *Navy Operational Concept* (1997), identifies five fundamental roles of the Navy: sea control and maritime supremacy, power projection from sea to land, strategic deterrence, strategic lift and forward naval presence. Although these roles are not new, in the future the Navy will fulfil them with vastly enhanced capabilities. The Navy has embraced the concept of network-centric warfare which places greater emphasis on the sensor and surveillance systems of a group of warships, submarines or aircraft, rather than on the particular attributes of the platform itself. The critical element in this approach is the timely exchange of data among many diverse platforms that will allow U.S. navy commanders to move their forces or take actions before the enemy can react.

The naval contribution to dominant manoeuvre will be to use the sea to gain advantage over the enemy, while naval precision engagements will use sensors, information systems, precisely targeted weapons and agile, lethal forces to attack key targets. Naval full-dimensional protection will address the full spectrum of threats, providing information superiority, air and maritime superiority and theatre missile defence. Finally, naval forces will increasingly be called upon to provide sea-based focused logistics for joint operations in the littorals.

The Navy has established a Maritime Battle Center to coordinate fleet battle experiments using advanced technology.

Marine Corps Vision

Operational Manoeuvre from the Sea, the Marine Corps' vision of future warfare, foresees an international security environment that requires tactically adaptive, technologically agile, opportunistic and exploitive forces. Individuals and forces must be able to quickly reorganize and reorient across a broad range of new tasks and missions in rapidly changing operational environments. The focus is on littoral warfare and particularly projecting power ashore for a variety of potential tasks ranging from disaster relief to high-intensity operations.

The focus of Marine Corps efforts with respect to the revolution in military affairs is on enhancing the individual Marine and his or her ability to win in combat. Through its five-year Sea Dragon program, begun in October 1995, the Marine Corps has developed an extensive experimentation plan divided into three phases, each culminating in an advanced warfighting experiment. Hunter Warrior examined littoral warfare, Urban Warrior, begun in 1997, is looking at operations in urban areas, and Capable Warrior will focus on high intensity conflict at the theatre level.

Army Vision

Army Vision 2010 provides the blueprint for the Army's contributions to the operational concepts identified in *Joint Vision 2010*. Released in November 1996, it focuses specifically on the land components of dominant manoeuvre, precision engagement, full dimensional protection, focused logistics and information superiority. *Force XXI*, a process driven by Training and Doctrine Command, is carrying out *Army Vision 2010* by identifying new technologies and concepts of land warfare that are expected to have radical implications for the Army's organization, structure, operations and support. According to *Force XXI*, lighter, more durable equipment will enhance deployability and sustainability, and advanced information technologies will help the Army conduct precision operations. The force will be protected by advanced but easy-to-use sensors, processors and warfighting systems to ensure freedom of strategic and operational manoeuvre. Overall, the Army will require flexible, highly tailorable organizations to meet the diverse needs of future operations.

Like the Marine Corps, the focus of the Army's efforts is on enhancing the individual's ability to win in combat. Indeed, while Navy and Air Force officials are striving to keep their people removed from the combat zone, the Army intends to capitalize on its most valuable asset the foot soldier by providing troops with the equipment necessary to transform them into super soldiers as deadly as tanks and as reliable as surveillance satellites. A major component of this process will be to digitalize the Army by equipping each soldier and vehicle with a small computer that displays a map of the battlefield overlaid with friendly and enemy positions and aircraft flight paths.

The *Force XXI* process is meant to address any threats the Army may face until at least 2010. Looking further to the future, the Army has also established the *Army After Next* program with the mission of conceptualizing the geostrategic environment between 2010 and 2025. The program strives to lay the research foundation necessary for assessing the effects of the increased mobility, lethality and manoeuvrability of land forces on future warfare.